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Line Production of "Caterpillar" Tracks

By L. C. Morrow

Managing Editor
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TRACKS of the "Caterpillar" track type tractors, product of the Caterpillar Tractor Co., San Leandro, Calif., are made up of left-hand links, right-hand links, track pins, track bushings, cotter pins, and shoes. The pictures on this and the three following pages show the line production of the links and the assembly of the several parts to form the tracks. The link is a drop forging, drilled in the large end to receive the track bushing and in the small end to receive the track pin, both of which are inserted under hydraulic pressure. The shape of the link is shown in several of the illustrations. Short roller conveyors are used to transport the links from machine to machine.

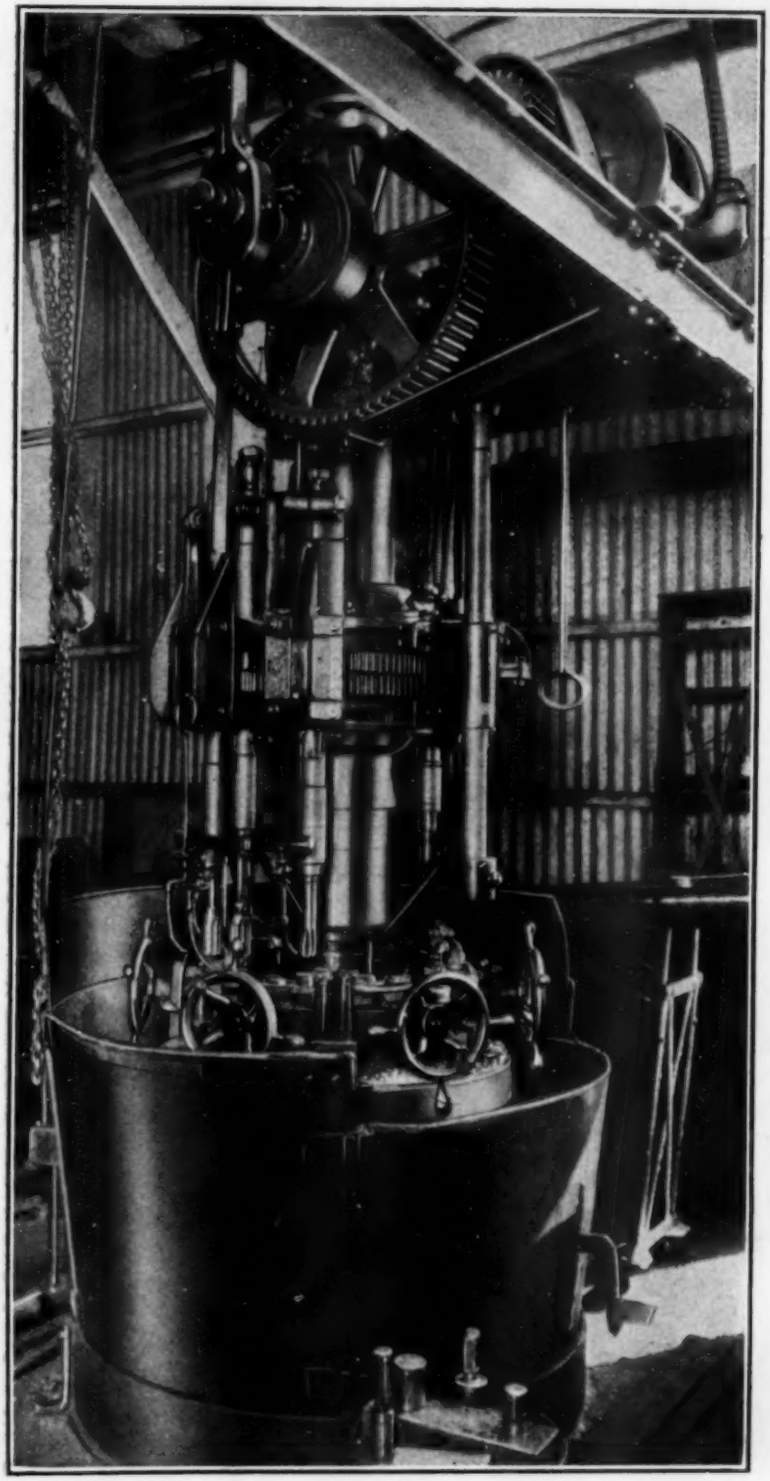


Fig. 1—Operation 1. The track-bushing and track-pin holes are drilled on an 8-spindle, six-station machine designed by the "Caterpillar" company. While two of the stations are being loaded, drilling is proceeding at two stations and reaming at two. Alternate stations are loaded with right-hand and left-hand links, so that the links will leave the machine and travel along the line in pairs. The dimensions given on the gages are "Go 1.305, no-go 1.307" and "Go 1.982, no-go 1.984."

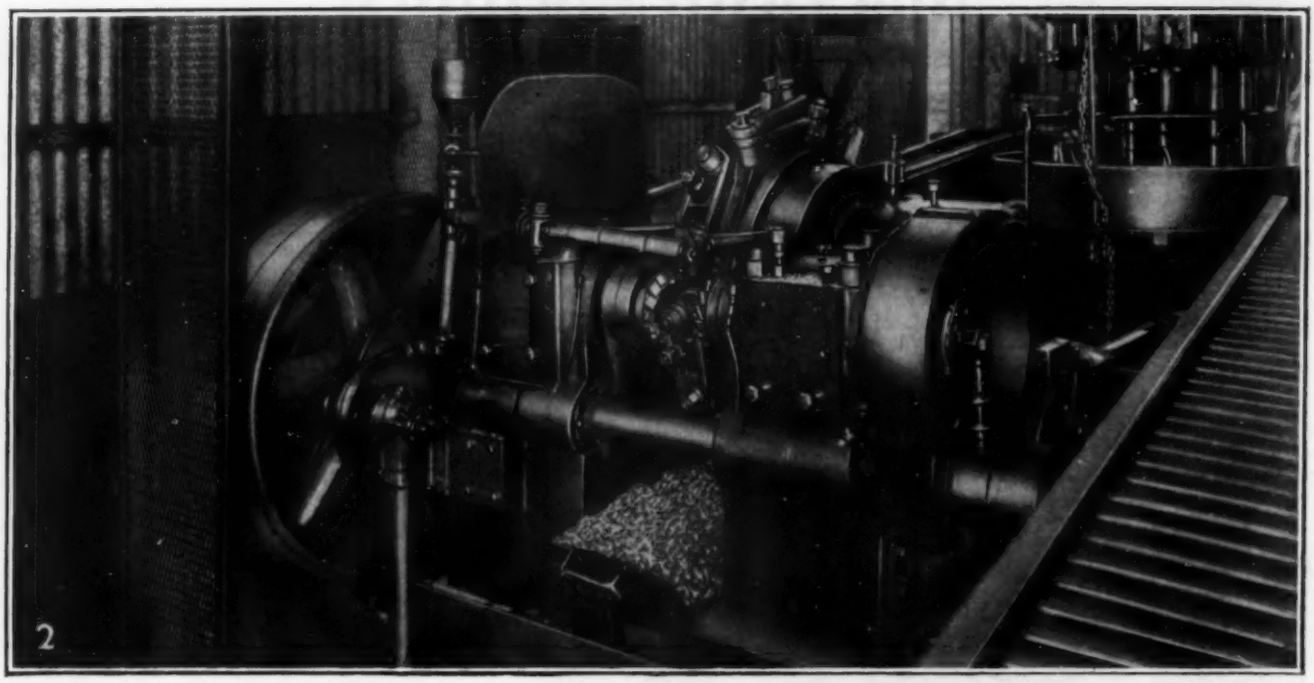


Fig. 2—Operation 2. Both sides of the links are milled on a 2-spindle drum-type miller of "Caterpillar" design. The drum has eight stations.

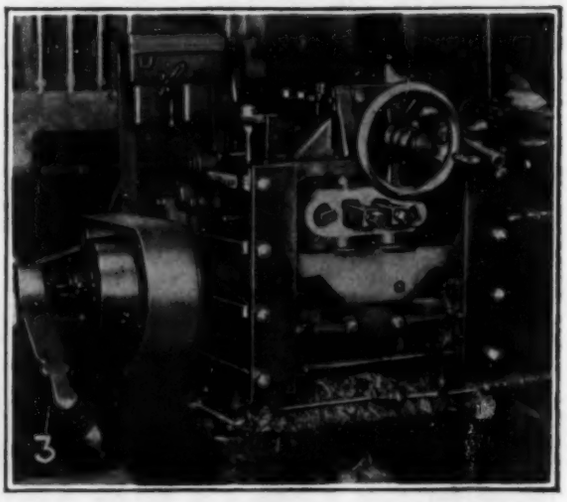


Fig. 3—Operation 3. Openings in the body of the link are shaped on a two-cutter, draw-cut shaper of "Caterpillar" design. These openings are provided to receive and retain the nuts of the track-shoe bolts. The links are held in the fixture by air-operated clamps, and are located by a pin that enters the large hole and pins against which one of the milled sides bears.

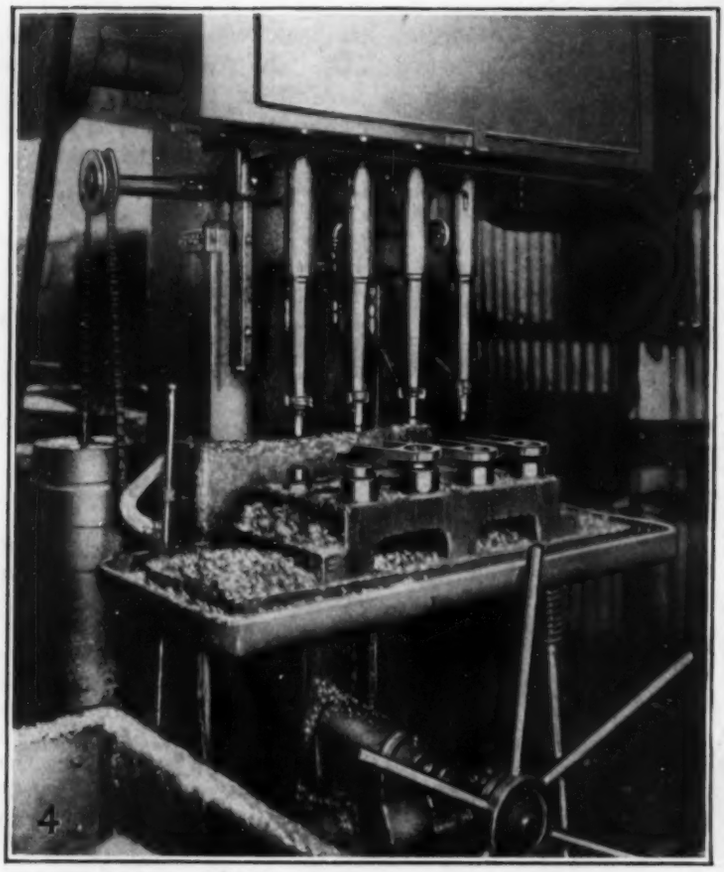


Fig. 4—Operation 4. The small hole is countersunk to receive the track bushing in a 4-spindle Moline "Hole-Hog" machine. The links are located on pins, drilled to receive the pilots of the cutter bars, and fly-cutters are used.

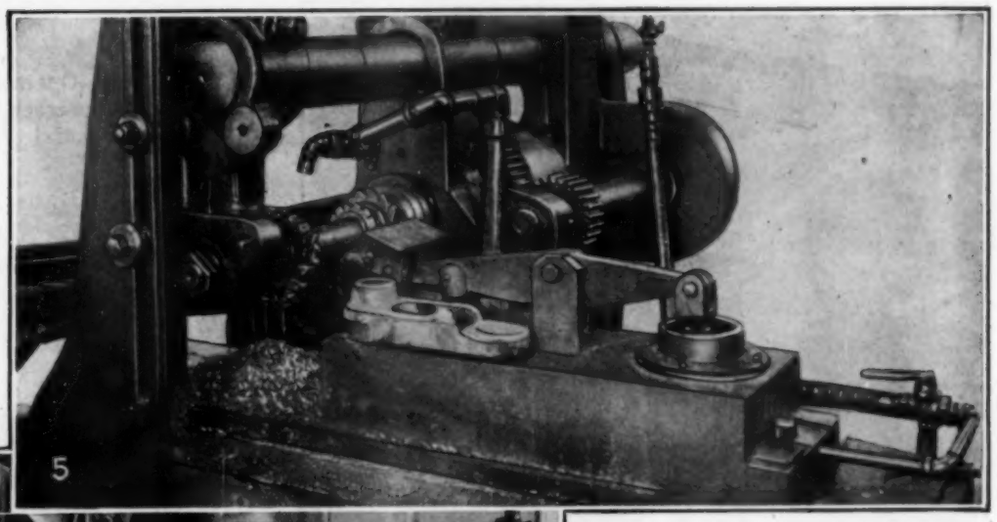


Fig. 5—Operation 5. Cotter-pin slots and clearance slots are milled on a Kempsmith machine. An air-operated equalizing clamp is used. For purposes of illustration the swinging end of the clamp was thrown back, but in operation it hangs down and bears against the body of the link.

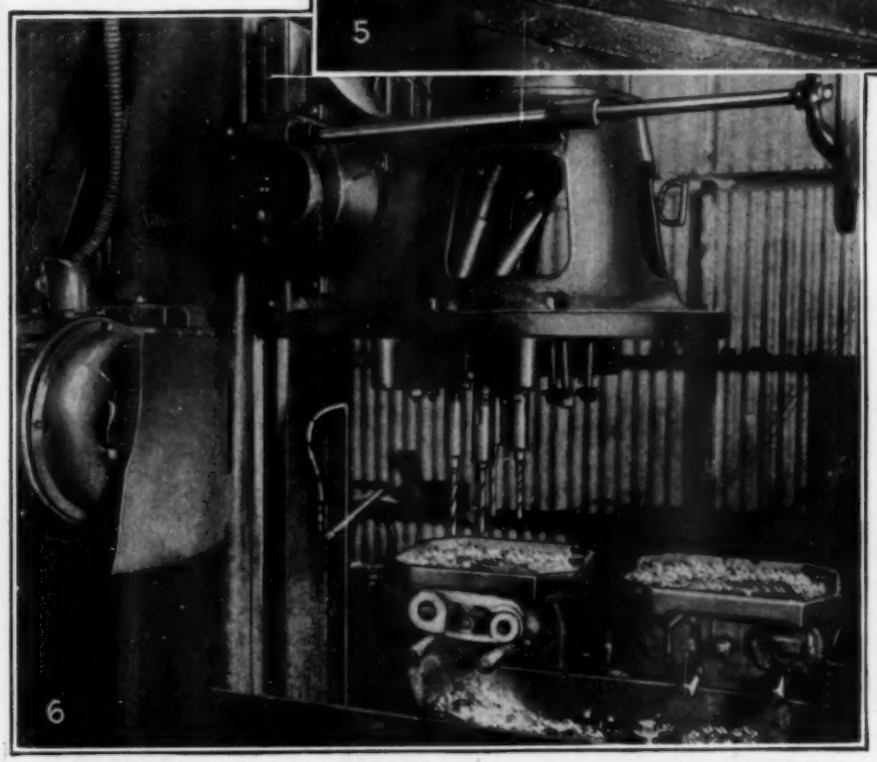
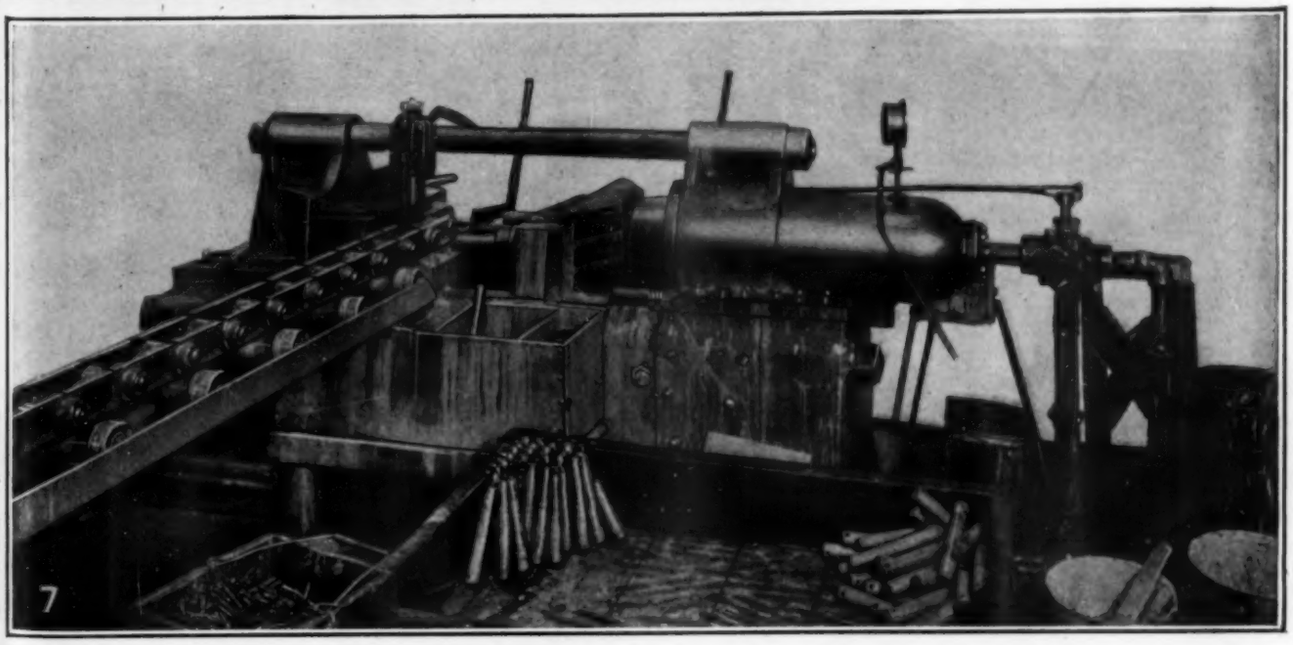


Fig. 6 — Operation 6. Track bolt holes are drilled on a Harrington machine with 4-spindle head. A two-station swiveling fixture, for loading and drilling simultaneously, is used. Each fixture is loaded with a right- and a left-hand link. The clamp is operated by air.

Operation 7 (not illustrated) is heat-treating.

Operation 8 (not illustrated) is drawing.

Fig. 7—Operation 9. The track is built up on a hydraulic press, a track pin and a track bushing being pressed in, and two links added at each stroke.



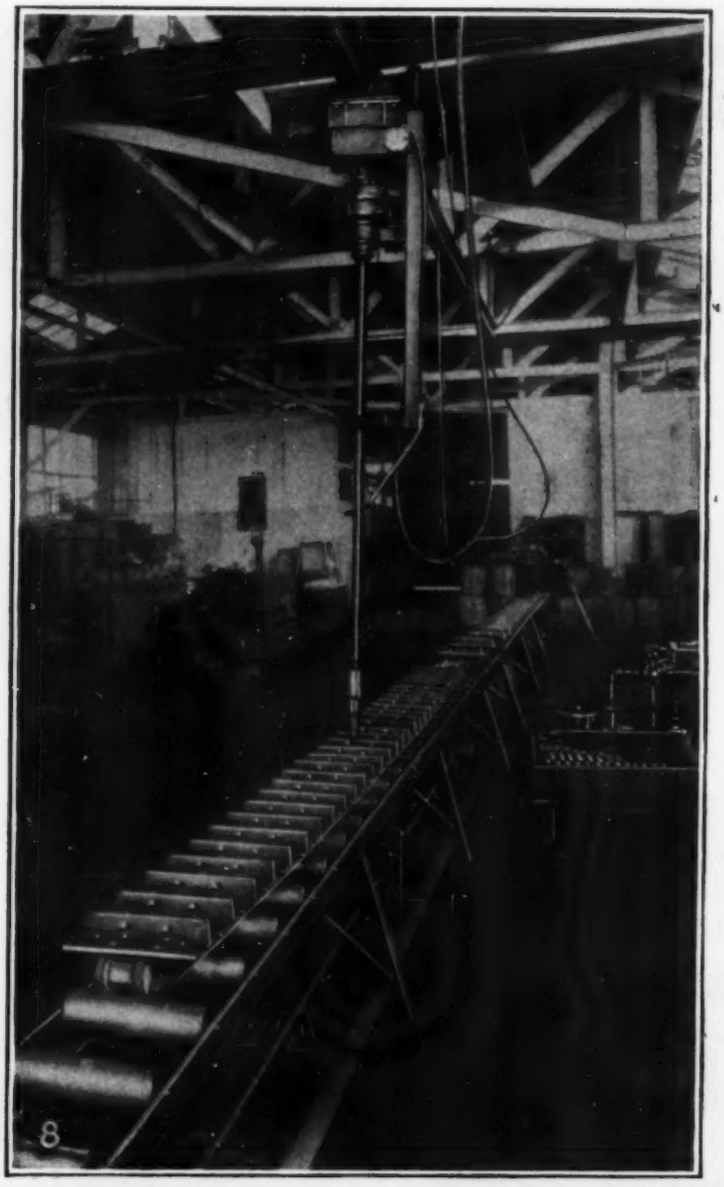
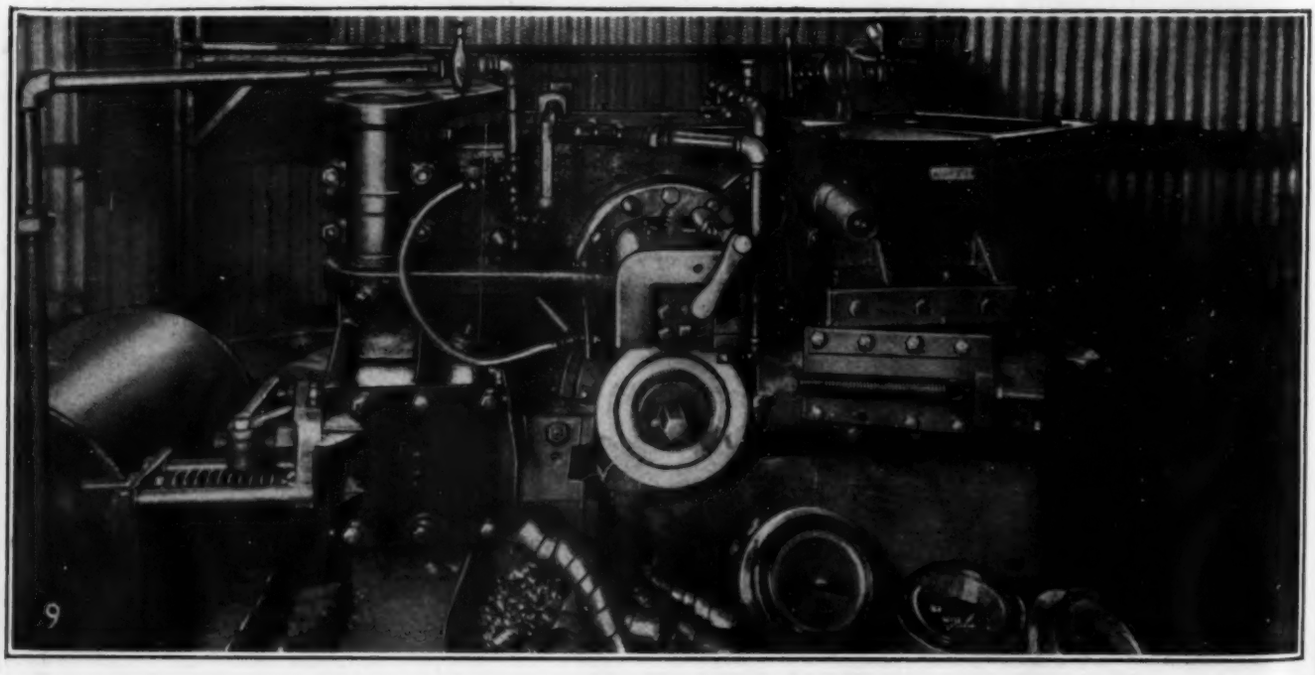


Fig. 8—Operation 10. Shoes are bolted to the track by means of a pneumatic tool carried on a trolley.

Fig. 9—Although not a part of the track, the track roller is closely related to it. On the "Caterpillar"-designed machine shown, in turning the rims of track rollers metal is removed at the rate of 480 lb. per hr. The roughing cutter is 1¾ in. wide and the finishing cutters are 2 in. and 2¾ in. wide. There is also a single-point tool that takes a cut across the rim. The cutters are actuated by cams and the machine is driven by a 25-hp. motor.



Orderly Maintenance in a Diversified Manufacturing Plant

By Frank I. Wheeler, Jr.
Plant Engineer

Power plant maintenance—Control of electric motor routine inspection and repair—Check on fire protection equipment—Tool maintenance and the tool crib—Value of the system and its effect upon production

RECORDS are kept of all power-plant equipment on machine record cards filed in the machine card drawer. This equipment is also numbered according to a mnemonic system and descriptions and history are placed upon the cards in the same manner as for regular machinery. There are three boilers, and one of them is out of service every six weeks for overhauling and inspection. These period inspections are noted upon the boiler card together with notes concerning repairs to brickwork, arches, grates, stoker equipment, and the like. In a similar manner record is kept of the life of pump packings, valve conditions, and so on. Most of this equipment receives a daily inspection by the engine-room force, but is checked up once or twice a year by means of the tickler. The tickler controls many inspections in the power plant. Play in rods and other moving parts of the engines are checked up every six months and once a year indicator cards are taken. A weighted coal test of boilers is made twice a year and the boiler tubes are turbined once a year in order to remove scale. Stationary and portable coal conveyors are examined every three months. The main drive belts for the engines are inspected and treated once a year. The spray pond is drained and cleaned every six months. An inspection of steam piping for proper covering is made throughout the plant yearly. The plant heating system is examined in the spring and drained, and is tested in the fall just before regular operation.

The maintenance department receives a daily report on the consumption of coal, water, and electricity, from which curves are plotted. A chart is also plotted monthly showing the plant's use of city water, gas, and outside electrical service. By means of graphic gage records, a daily check is also kept on the various steam pressures and the temperatures of the feed water and flue gas.

Record cards are kept for electric motors in the same manner as for machinery. The motors are identified by means of a room number and a motor number; for

The third and concluding article.

EQUIPMENT RECORD

Description Driver 9URI Type 5 - 4 pole shunt MACHINE NO. 9-1
Make Westinghouse Makers No. 12
Bought of John Robertson and Co. Order No. 2481 Date Jan. 26-06 Cost #720 25 for
525 R.P.M. 50 H.P. 250 Volts 166 Amps K.W.
MACHINE TO BE INSPECTED EVERY 6 Months Brushes 2½" × 2¼" × ¾"

INSPECTED	REMARKS	REPAIRED	TIME HOURS	INSPECT AGAIN
7-1-20	Record started OK			3-1-21
3-1-21	"			9-1-21
9-1-24	Holes in commutator between bars caused by wood dust			3-1-25
11-1-24	18 holes in commutator cemented - some 1" deep between bars	11-1-24	A-10	3-1-25
3-1-25	OK			9-1-25
9-1-25	OK			3-1-26
3-1-26	Pulley fitted to motor so motor can be used in emergency			9-1-26
	(Pulley cost #28.30) in place of 7-2 driving main shaft room 7	5-4-26	E-5½	

Fig. 6—Electric motor record card

example, motor 7-2 is motor No. 2 in room 7. The motor card, shown in Fig. 6, measures 8x5 in. On it is marked the motor number, the number of the machine it drives, the maker's name and number, the date of purchase, the price, the order number and from whom bought, and engineering information such as speed, horsepower, volts, and amperes. The size and style of brush best suited for the motor is entered upon the card in pencil. In case a reserve motor has been provided, sufficient information about this motor is also placed upon the card. For all important drives a motor is kept in reserve or can be taken from an unimportant drive. Extra pulleys have also been provided in some cases for this purpose.

The first entry in the space for motor history is the installation date, together with the hours of labor devoted to that work. Records of brush troubles, commutator turnings, rewinding of armatures, repair of open coils, short circuits, etc., then follow with dates. Regular inspection reports are also noted.

When a motor is moved its number is changed just as in the case of machine numbers and a new card is started. The old number is never used again. An inactive file is maintained similar to that for machine cards.

Set a Good Example

Electric motors are cleaned regularly, usually once a week, except in very dirty spots where they may be cleaned twice a week. It was found that this cleaning of the motors encouraged the foremen of the various rooms to keep the entire room in presentable shape. Reserve motors are examined and cleaned once a year, and as far as possible are stored in one location. Owing to the generally clean condition of the plant, motors are blown out by air jets only when overhauled.

Routine inspection of motors is made every other day. Sparking, chattering, cutting, high mica, dirty slots, poor brush pressure, and other points that indicate the running condition of the motor are noted. Repairs that are easily made are done without the use of a maintenance order, but if the work is extensive an order is required. Recurring weaknesses are reported for record. In addition, a general inspection of all motors is made every six months for both electrical and mechanical defects, such as bad bearings, loose set screws, worn keyways, loose connections, misalingment, and the like. This six-month inspection is controlled by the tickler cards, and the report turned in by the inspector gives a description of the work required to put the motor in condition. All motors that are not on this report are considered certified O.K. This report is regularly transcribed to the motor record card.

Special motorized equipment, such as electric drills, portable grinders, vacuum cleaners, and so on, receive inspection at regular intervals as controlled by the tickler. Circuit breakers are also examined every three months. Fans are inspected and oiled every spring. A fan card listing all fans is kept in the motor card section of the file.

All lamps and shades are cleaned according to a schedule, determined by experience, to maintain all lamps in neat condition. Lighting fixtures are examined every four months and are put in good condition. Looseness of attachments, proper play in joints, rustiness, and the like are noted. Record is kept of the number of lamps purchased yearly.

A card similar to the motor card is kept for each meter. The name of the instrument, its maker, serial number, range, and other data are placed thereon. Instruments are checked yearly for accuracy. Several miscellaneous items in connection with electrical maintenance should be noted: The switchboard in the engine room has under each feeder switch a cardholder in which is placed a card listing the motors and light circuits served by the feeder. Refill fuses are held ready for all needs and a daily report is made of the number of fuses replaced. Contacts of generator field rheostats and other important contacts are cleaned every four months. The bell call system is tested every three months after the plant has shut down for the day.

Maintenance of fire-protection equipment is another function handled by means of the tickler system. Fire-alarm bells that are connected with the system are tested every Friday. Fire pails are examined and filled to proper level once a month. Fire extinguishers are emptied and refilled once a year. They are located in each room in a position to be easily seen. In addition, a bright red band is painted on the light gray beam just over the extinguisher. Fire doors are examined every month to see that they are not blocked or out of order. Corners of the buildings are examined for waste collection every month. All fire hose is unfolded and examined and a percentage tested under water flow in pressure every year, so that all the hose in the plant receives a water test at least once in every five years. The fire reservoir tanks receive a yearly inspection in the spring for need of paint or other repairs. Sprinkler heads located in places that are exposed to acid fumes and the like receive a regular special inspection. Spare sprinkler heads are kept in a special labeled box, partitioned to separate those rated for different temperatures. The fire pump is turned over at regular intervals, and it runs for the hose test once a year. The parts of the sprinkler system that are subject to freezing are closed every fall and opened every spring. Inspection is also made each fall to see that no skylight or roof opening near the sprinkler piping is left open with the possible result of freezing.

Everything in Its Place

In order to properly maintain tools, a tool crib was established in the machine shop in place of the open shelving along the walls that formerly contained various stock more or less mixed up. Tools and hardware in required sizes and varieties are stored so that they can be readily located in the crib. Spares for machinery, attachments for various machines in the machine shop, clamping bolts, electric drills, portable lighting fixtures, and other handy equipment are kept in the crib in addition to the tools and hardware. Space is allotted for each group of supplies and tools, each space being labeled. To each drawer or shelf space is attached a tag on which is written the name of the material, its size, and the minimum quantity to be on hand, together with the amount to be ordered each time. The tool-crib boy notes in pencil on these tags each issue of material and subtracts it from the previous amount on hand to determine when a requisition for more material should be made.

Tools are kept sharp and in condition for immediate use. Dull tools must not accumulate nor be issued at the window, and hence tools are examined upon return for their condition. A precision bench lathe and a universal grinder are set up in the tool-crib space to insure that they will be operated only by men properly trained. They are used in conditioning the crib tools by the tool-

maker stationed in the crib for that purpose and also used by him in other toolmaking orders at times when his labor is not required for tool-crib work. A work bench is also provided. The tool crib now furnishes on requisition a considerable part of the hardware used by the plant.

Each man regularly using the tool crib receives ten tool checks stamped with his number. No tools are issued except on check. When other departments wish to borrow tools temporarily, round, brass-rimmed paper checks are signed by the messenger and deposited in the drawer in place of the borrowed tools. Material is issued only on charge slips, on which the order number of the job for which the material will be used is stated. Entry is made from these charge slips into an account book provided for this purpose.

The men are encouraged to make a record of tools and equipment needed that are not in the tool crib. The request is written on a charge slip which is forwarded to the maintenance department.

As there is considerable use of the tool crib by maintenance men outside of working hours, the key to the crib is left with the watchman. The man securing this key must sign for it and accept responsibility for the crib while open. Also, each man entering the crib outside of working hours must sign a pad provided for that purpose and must also note any material used. As a general rule, however, the men are expected to estimate the tools and materials required for an overtime job and to secure them before the tool crib is closed.

A Check on Condition

A weekly report is made to the maintenance department showing the number of tools broken or lost, together with a list of new articles requested by the men. Tool checks are accounted for once a year. By means of the tickler, the condition of drills, milling cutters, mandrels, parallels, taps, and so on, is noted to see that the tool-crib boy and the toolmaker are keeping them in proper condition. Tools and other articles are oiled regularly to prevent rust.

Tool steel is painted with different colors to distinguish the manufacturer and the grade. This is done to avoid confusion with the machine steel stock which is not painted. The iron and steel stock is kept properly sorted in racks in the machine shop. It is checked at intervals by means of the tickler.

The hardening of steel dies is a part of the work of the machine shop. By means of a temperature recorder, a chart is made and kept for each die hardened. Stamped on the curve sheet is provision for other information, such as the die number, the date hardened, the brand of the steel, the Brinell hardness number, and the temperature at which it was drawn. The pyrometer is checked for accuracy every three months by means of the tickler. The Brinell meter is examined and the brine tank is cleaned and repainted yearly from orders initiated by the tickler. The oil in the tempering furnace is renewed every six months.

Production is affected by maintenance in two ways: directly by the smooth operation of equipment, and indirectly through the improved morale of the employees. Cleanliness, including good painting, and orderliness, proper lighting, ventilation and reduction of drafts, proper heating, reduction of noise and vibration, comfortable seating, safe operation, and good sanitary conditions have all contributed toward making the workers satisfied.

The value of such systematic maintenance is easily seen. Because repair orders are in writing and are not dependent upon the memories and whims of the maintenance foremen, the manufacturing foremen do not become discouraged and withhold reports on need of repairs until pressed by sudden urgency. Losses due to the continued running of equipment in bad condition is avoided. Systematic follow up of maintenance orders has eliminated the overlooking of repairs. Makeshift repairs are also eliminated. Written records give reliable information on past service, and chronic weaknesses of machines can be removed.

The operators expect the inspection trip and get in the habit of making suggestions and requests of value that had previously been lost. In the end, more improvements are made to equipment under such an organized maintenance system. When need of repairs is indicated by an examination, there is generally time to arrange for the work at an opportune period.

It is important to note that the machine inspection system is based on individual machines. Inspection by rooms or large groups tends to deteriorate to a perfunctory service. The sense of responsibility of the inspector is not as strong in that case as when he is required to certify as to the condition of each particular machine.

A plant operating such a system as described can make a change in maintenance executives or mechanics with less confusion than ordinarily would occur since a written routine is provided that continues in effect. The tickler system is flexible enough to provide a medium for installing and then definitely terminating a temporary routine put in operation to overcome some difficulty or problem not permanent.

In conclusion, the chief objects of a maintenance department are upkeep, neatness, and smooth operation. In achieving these results in this particular factory, considerable reliance has been placed on the "tickler" feature, and it has a prominent position in the articles. It is not desirable, however, to have it eclipse the other features of the system, which, in a plant with different manufacturing problems, might be of greater relative importance in obtaining the same results.

Standards for Gage and Key Sizes —Discussion

By B. R. Sheets

IN THE *American Machinist*, Vol. 66, p. 258, K. E. Summers discusses standards for gage and key sizes. There is this criticism to offer on Mr. Summers' article: Let's cut out the just suppose, and get to work on the S.A.E. Standards Committee. In my opinion this committee has accomplished much in its work of standardization. We do not wish to presume that these men are overlooking any bets, but it will not cause any ill feeling to mention some more to them.

On the desk before me are eight tables of gage sizes, no two of which coincide for the same gage number. For example, No. 10 Malins Wire is 0.024 in., while No. 10 American or B & S gage is 0.10189 in., and No. 10 U.S.S. plate is 0.140625. Why the five millionth part of an inch is used is a mystery. As a further example of the inconsistency of number sizes we find one of the large steel manufacturers listing No. 10 round polished high speed drill rod as 0.1935 in., while on the next page No. 10 round polished drill rod in carbon steel is 0.191 inch.

Experiments on Horizontal Quarter-Turn Belt Drives

SOME experiments were recently made on horizontal quarter-turn belt drives to determine their capacity as compared with normal horizontal drives and to try out certain combinations of pulleys and center distances in the hope of learning more about the practical layout of this type of drive. The results showed that at slips up to 1.5 per cent there is practically no difference in the transmitting power of the two drives. At high slips the advantage is with the normal drive, especially with belts of high capacity. If the center distance is within the limits of good practice, its amount has little, if any effect on the difference between the two drives, unless this distance is so short that the belt does not conform well to the quarter-turn drive.

For the purpose of design, a horizontal quarter-turn belt should be at least 5 to 10 per cent wider than a normal belt, other conditions remaining the same. The higher figure need be used only if the conditions are severe. It is not certain that these figures would apply to a belt much wider than 4 in., but they should if the belt conformed well to the drive and was in good contact with the pulley.

There is no theoretical reason why a quarter-turn belt should not be able to carry as much load as a normal belt, except that the tension varies across the width. The total area of pulley contact is less, because the short edge is not in good contact at certain points, but theoretically this should make no difference; practically it may have some effect, however. On the other hand, the effective arc of contact is actually greater on a quarter-turn belt than on a corresponding normal one. The short edge of the belt does not come on the pulley as soon as the long edge. In fact, it may not touch all the way around, but the edge that carries the load makes contact with the pulley, throughout the entire theoretical arc of contact, which is always greater than 180 deg. on both pulleys.

Influence Life of Belt

In several instances the length of the long and short edges of the belt were measured. The difference was found to vary from $\frac{1}{2}$ to 3 in., the last figure being obtained when a 30-in. pulley drove a 6-in. pulley with 6 ft. center, a very severe condition. The difference in length of the two edges is caused by the fact that the same edge has to take the outside of the curve formed by the belt as it leaves either pulley. The shorter the center distance for any given pulley, the sharper this curve and the greater the strain on the belt. Since the curvature depends upon the pulley diameter and the center distance, it follows that these factors have an important influence on the life of the belt.

In almost every instance where a leather belt was installed fairly tight, a certain amount of squeaking was present, even at no load. This was caused by the tendency of the belt to slip sideways just before it left the pulleys. If the belt was under load the squeak usually originated at the side where the belt left the pivot pulley, because this was the tight side, and more resistance was offered to sidewise slipping.

In general, a quarter-turn belt will stay on the horizontal pulley better if the horizontal pulley is used as the driver, because the sagging strand then feeds onto the driven pulley, which is in a vertical plane. Hence, the belt will run true, regardless of the sag of the loose side. When the load is variable the belt has a tendency to run in a different place on the horizontal pulley for every change of load. This difficulty is experienced with loose belts and long centers or high speeds and may be overcome by tightening the belt.

Abstract of "A Report of Experiments on Horizontal Quarter-Turn Drives," by R. F. Jones, Research Engineer, Leather Belting Exchange Foundation, Cornell University, Ithaca, N. Y.

Repair of Valve Motion Pins and Bushings

THERE is a tendency in some railroad shops to adopt standard oversizes for parts such as valve-motion pins and bushings. This follows the automobile practice of repairs to some extent, as in the case of piston pins, pistons and piston rings. By this method, parts that are a definite amount above the normal size are carried in stock so that holes can be reamed or ground to the next larger size and the oversize part used without special fitting.

Pins and bushings for locomotive valve motions could be handled in much the same way, and some shops are making up both pins and bushings in turret lathes, leaving the final finishing to be done when the repair is made. But few, however, are using a standard oversize, although it is being considered in some shops.

Inquiries show that while some shops do not salvage either pins or bushings, others salvage them by regrinding. In one such shop they allow $\frac{1}{8}$ in. either over or under size respectively for replacing pins and bushings. Such an allowance requires a very deep penetration in the case—$\frac{1}{8}$ in. being required on this kind of work, in this instance.

Bushings are sometimes made from cold-drawn steel tubing, which can be purchased with inside and outside diameters very close to the desired size.

Semi-finished pins vary from $\frac{1}{8}$ to $\frac{1}{4}$ in. larger than standard size, the extra stock being turned off when the repair is made. Some shops report that the pin wears much more than the bushing, so that the bushing seldom needs replacing. Pins with large heads are frequently upset in the blacksmith shop, rather than turned down from large stock.

Details as to shop practice regarding motion parts are given by one road as follows:

Machining: Bushings must be turned on the outside for a press fit into motion parts, so that the pressure required will be between 2 and 3 tons per inch of outside diameter. Bushings must be a close fit on the pins after they have been applied, and must be bored to a working allowance over the size of the pin.

This boring allowance for pins up to 1 in. in diameter is 0.005 in.; from 1 to 2 in., 0.01 in.; from 2 to 3 in., 0.015 in.; over 3 in., 0.02 inch.

Motion Parts: Motion parts must be reamed or ground so as to obtain a perfectly round and parallel hole before bushings are applied. The limit for reaming will be $\frac{1}{8}$ in. above original diameter, after which the hole must be built up by electric welding and rebored. Limit for wear for motion pins will be 0.020 in. less in diameter than the original size. Motion pins to be made of engine-bolt iron and casehardened. The penetration to be not less than $\frac{1}{32}$ inch.

Automotive Production

Machining the Morris Cylinder Block

By I. William Chubb
Editor, European Edition, American Machinist

Drilling and reaming valve-guide holes—Boring valve throats—Various milling operations—Special machine for tapping—Tools for boring and reaming cylinders

FOR drilling and reaming the valve-guide holes, a 16-spindle vertical drill (Fig. 14) is used, the work being indexed for reaming after drilling. Note may be made of the bushing plates used, the same system being employed in several other operations. The bushing plates lift with the drill head, in order to position or remove the work, the plate itself being held down by springs, while the cylinder block is located by a plug at each arm hole.

Boring the valve-throats (Fig. 15) follows, and then 15 holes are drilled (Fig. 16) in the top of the block in a Natco machine, a number of minor drilling operations then being undertaken. Fig. 17 gives a general view of the line up to this point. The breather hole for the sump is drilled, faced and tapped, with the work on a fixture at the required inclination. Under a jig plate, the bottom of the block is drilled, 18 holes being put in, including two for oil. In following operations, eight stud holes are drilled for the bearing block, and twelve holes for the bearing dowels are drilled through and reamed in a multi-spindle machine. These operations are followed by the tapping of the sump holes and the bearing-block holes in a special tapping head designed and made by Morris. The bearing block is loose, and is dowelled in position. Milling sides of the bearing-block faces and the camshaft boss, is shown in Fig. 18, a two-spindle horizontal machine being employed, also straddle mills for the five faces. In the actual cutting operation, the block and the fixture are between the operator and the cutter. As before, the work is located from the arm holes. A swinging bracket enables each arbor to be put into position and removed. After the chamfering of the cylinder bores in a four-spindle Moline machine (see Fig. 19), two holes are drilled for the magneto shaft, and two angular oil holes Fig. 20) with the work held on a swinging fixture. The exhaust- and side-plate holes are drilled through a jig plate (Fig. 21), and then tapped in a special Morris multi-spindle machine, this operation being followed by the drilling and tapping of the carburetor and steering column holes.

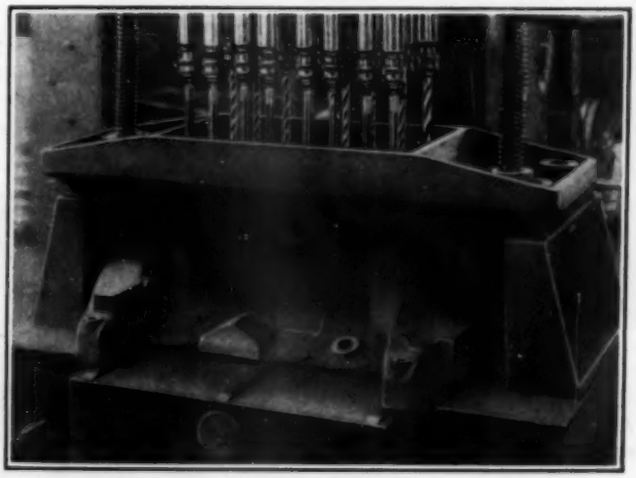


Fig. 14—Drilling and reaming valve-guide holes

In the next operation (Fig. 22) the cylinder is finish-bored, and reamed with a floating reamer. The work is held as in the rough boring. The cutting speed is 29.5 ft. per min. and the feed 1.6 in. per min. The front tools bore the hole to 69.3 mm. and the back tools ream it to 69.45 mm. The reaming blades are four in number, each with three straight teeth. They are secured by screws to a body which is driven by a tenon on a washer that is similarly driven by the shoulder of the boring bar. The front boring tools are 10 mm. square in section, and are secured in a disk, the boss of which is socketed in the end of the bar, and the whole head is secured by screw collar. Fig. 23, which also shows the setting gauge, gives details. The job, held on an inclined face (Fig. 24) is milled for the connecting-rod clearance, and the cylinder bore is then finished by rolling in a four-spindle machine, as in Fig. 25. In the previous operation, the bore has been reamed to 69.45

The third article. The fourth will appear in an early issue.

Automotive Production

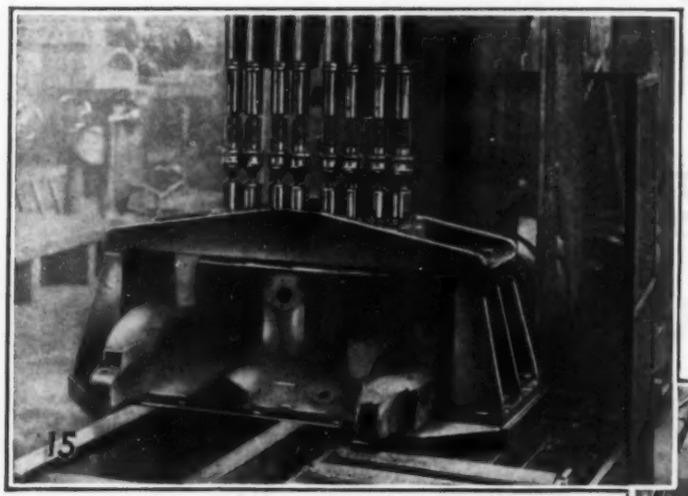


Fig. 15—All of the valve throats are bored simultaneously in this multi-spindle machine. Rails are provided to make easy the sliding in and out of the jig

Fig. 16—This Natco machine is engaged in drilling fifteen holes in the top of the cylinder block. A roller conveyor carries the work to and from the machine

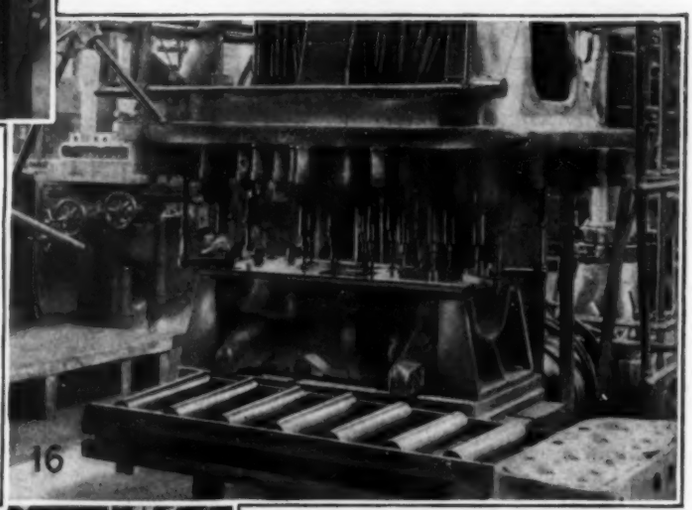
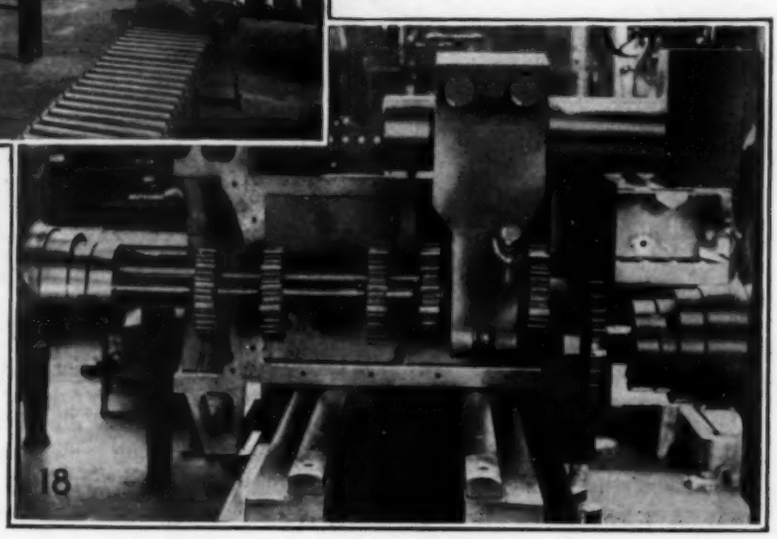


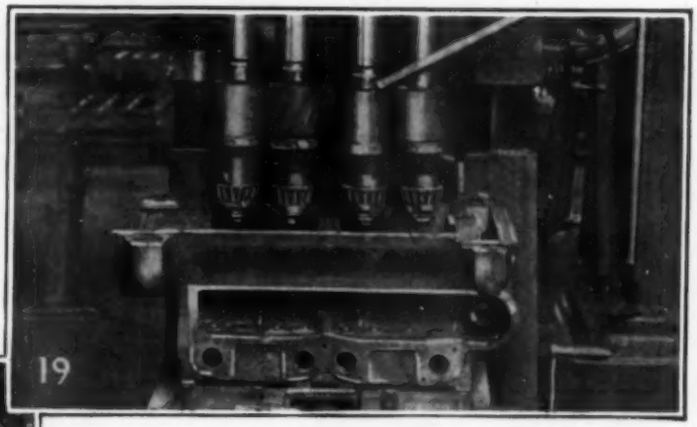
Fig. 17—A general view of the line of machines engaged in operations that have so far been touched upon. Roller conveyors are used throughout

Fig. 18—The sides of the bearing blocks and the boss around the hole for the camshaft are being milled. The machine has two spindles, and straddle and face mills are employed



Automotive Production

Fig. 19—The cylinder bores are chamfered in this four-spindle Natco machine. Here again rails are provided for sliding the jig under and away from the tools



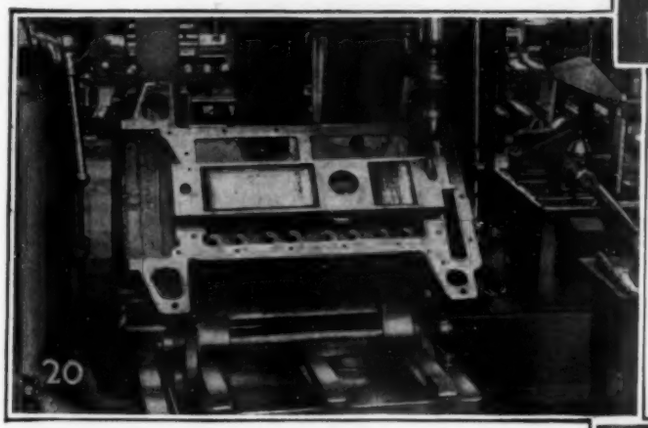
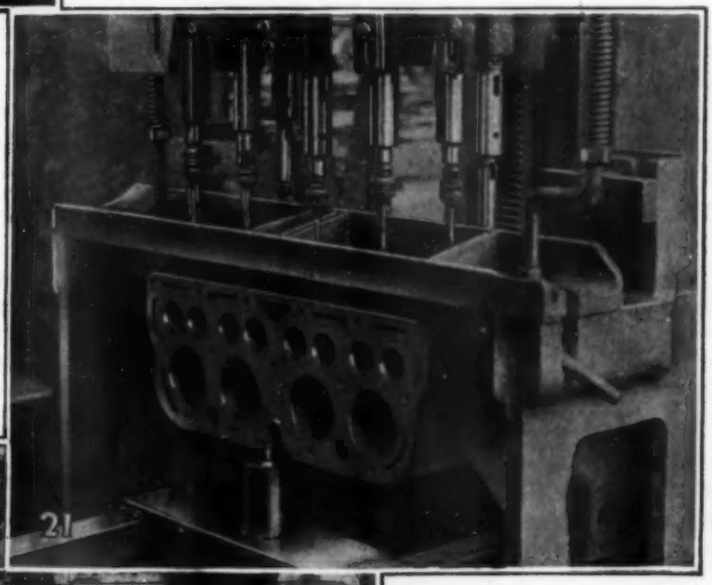


Fig. 21—The exhaust- and side-plate holes are drilled through a jig plate, and are then tapped in a special, Morris-built, multi-spindle machine

Fig. 20—In this picture the cylinder block is shown mounted on a swinging fixture, so that some holes can be drilled normally and others at an angle



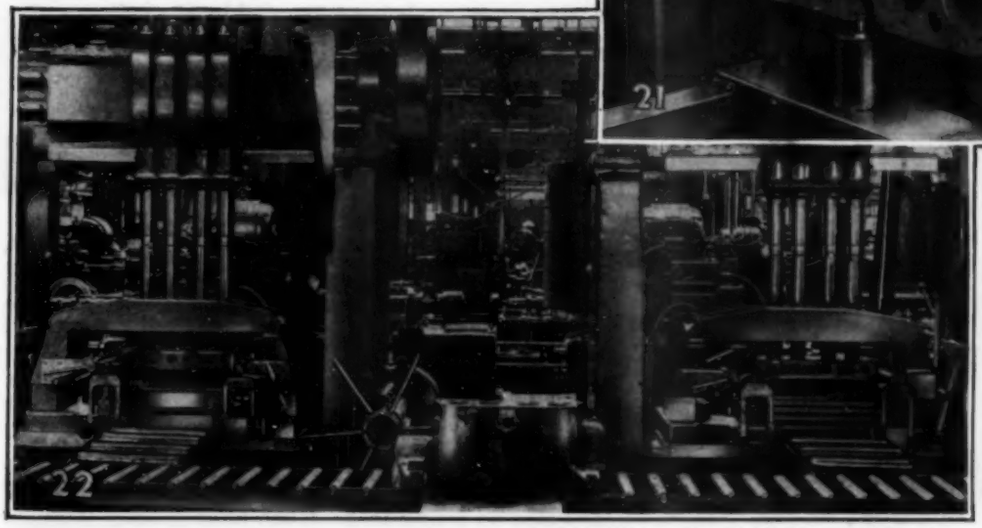


Fig. 22—Here the cylinders are being bored and reamed in multi-spindle machines. The latter operation is performed with floating reamers

Automotive Production

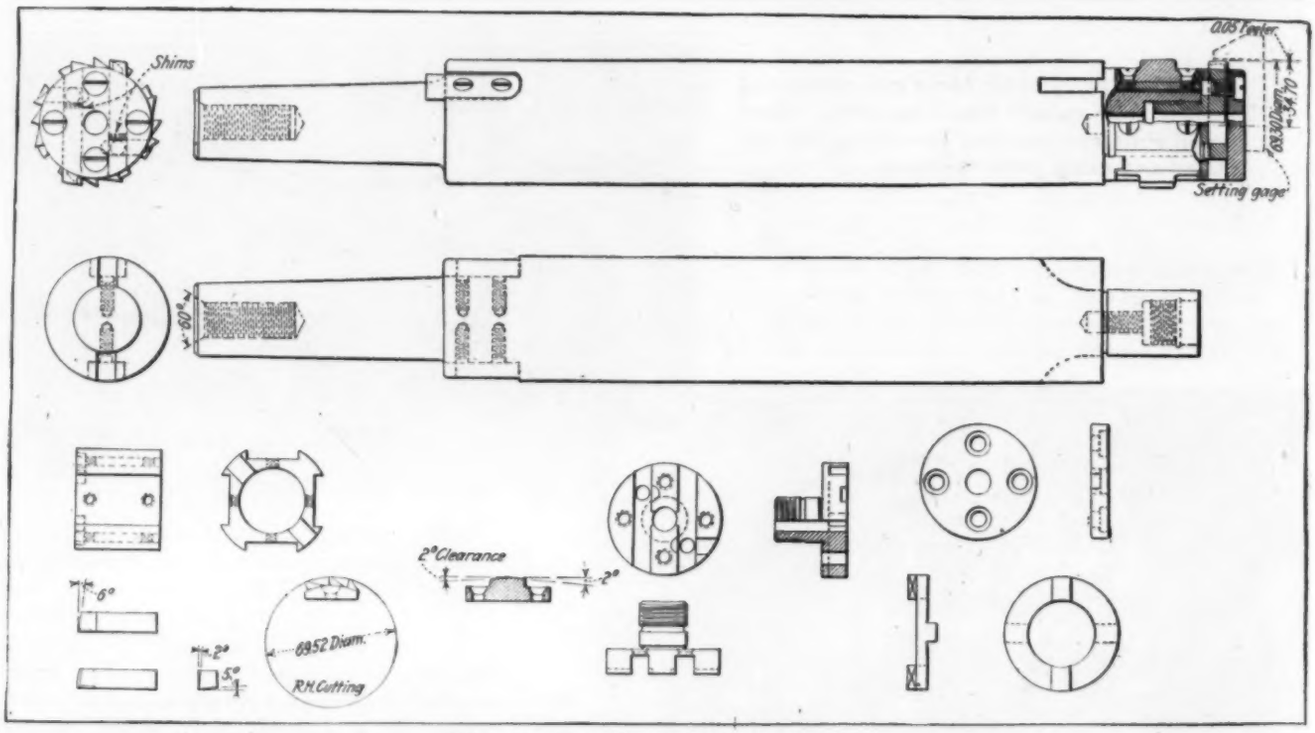


Fig. 23—Details of finish-boring bar

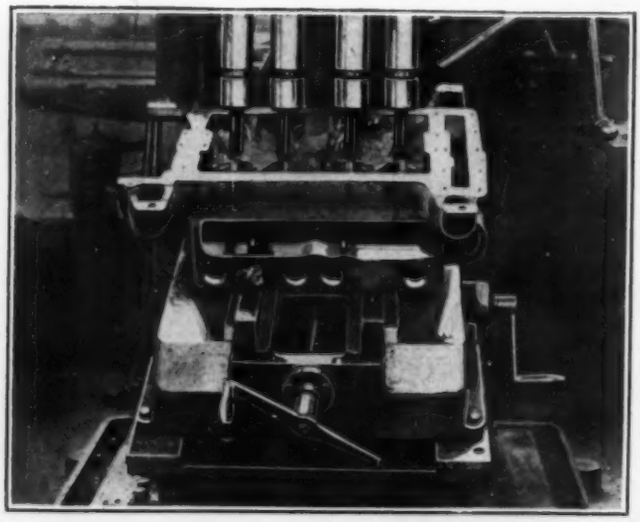


Fig. 24—Milling connecting-rod clearance in cylinders

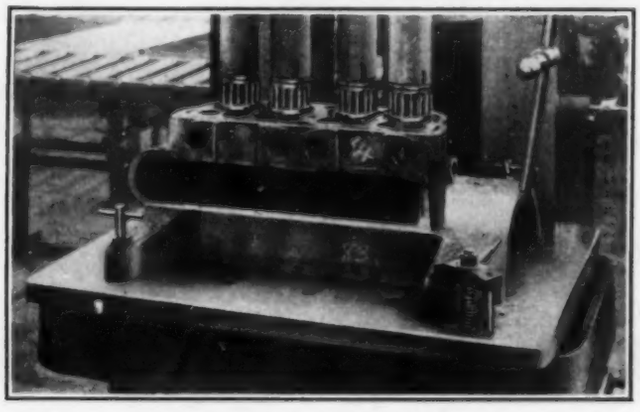


Fig. 25—Rolling cylinder bores

mm. and the final rolling brings it to 69.5 mm. The roller runs at 500 r.p.m. and is put once down the bore and then up at 10 in. per min. feed. With three spacing studs, the twelve rollers are held in a cage at an inclination of about 1 deg. from the vertical. They are of barrel shape, ranging from 11.24 mm. to 11.36 mm. in. diam., with a parallel central portion 4 mm. long. The rollers are of cast steel, hardened and ground, and the pressure is arranged to come on the cage and not on the spacing studs.

The water test for porosity is at a pressure of 80 lb., a rubber pad and rubber bung at each end making the joint. Minor drilling, tapping and counterboring operations follow, and then the stud holes are tapped. The bearing-block studs are driven home mechanically by means of an air motor, and the bearing blocks are assembled, this operation being succeeded by the bolting down of caps, nuts, and driving home other studs by hand.

Engine builders are looking forward to increased business since competition is forcing all automobile companies, regardless of size, to call in specialists in order to better their product. Beside this broader experience, which the motor builder can supply, he has better and more flexible facilities to offer. His machine tool equipment is largely elastic because the models of engines that he builds are of a wide range of sizes and types. The car builder, on the other hand, usually has single-purpose equipment, representing an enormous investment, which must necessarily be scrapped if an improved model is brought out. Such changes might also necessitate a substantial shop rearrangement with consequent serious interruption of current production. The independent motor builder can therefore get into production on a new model much more quickly than the average car manufacturer.

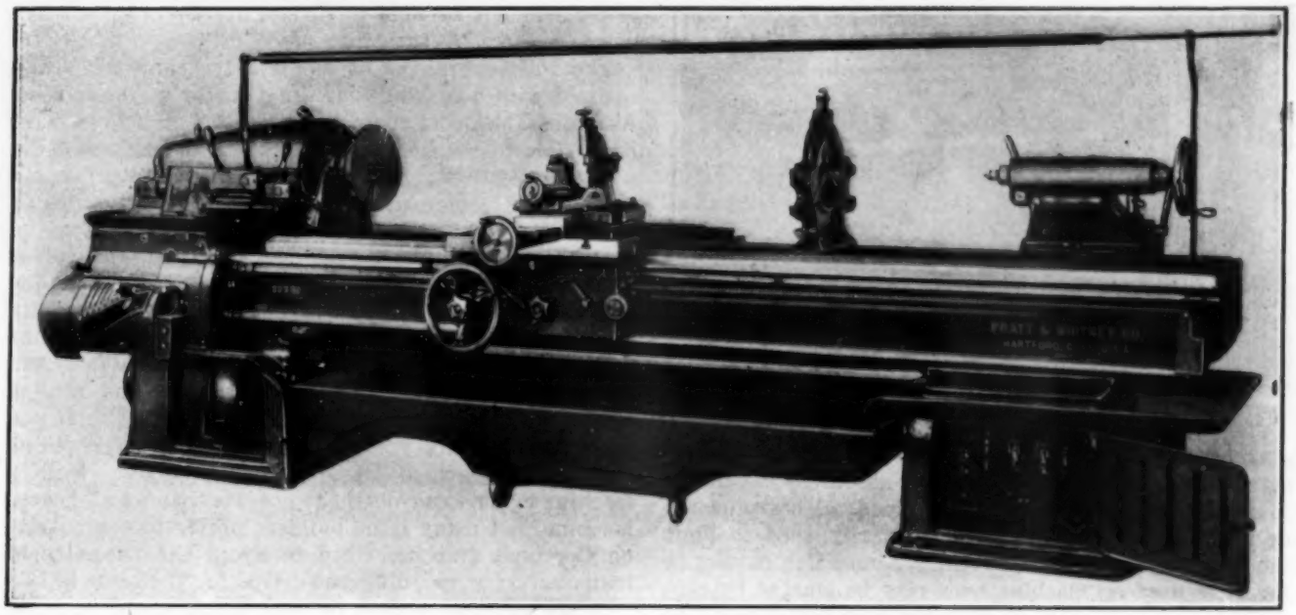


Fig. 72—Lathe with motor and controls in legs

Applying Electrical Equipment to Production Machinery

By Robert Corey Deale
Electrical Engineer, Niles-Bement-Pond Co.

Selection, mounting, and control of motors for small and medium size lathes — Spline shaft control from carriage — Carriage and tailstock traverse motors and controls for large lathes

THE oldest machine tool is the lathe. It was also the first to be equipped with a motor drive. Its requirements as to electrical equipment vary widely between those of the extremely simple small lathe and those of a very large engine lathe, which may have as many as seven motors auxiliary to the main driving motor.

Small lathes are usually driven by small a.c. or d.c. constant-speed motors. There is a growing tendency to design the smaller machines so that the motor is mounted inside the frame of the machine itself. The 20-in. lathe shown in Fig. 72 illustrates this construction very well. The driving motor is mounted in the cabinet leg, under the headstock, which has doors at both the front and back to facilitate inspection and minor repairs to the motor. The motor is put in place through the end of the pedestal, as shown in Fig. 73, which is closed by a removable cover. Openings in the doors and in the inner end of the pedestal itself provide ample ventilation. With this form of drive the motor usually runs continuously, and the lathe is started and stopped by means of a friction clutch, which is placed between the motor and driving gears in the lathe head and which may be operated from some convenient point on the machine. The cross bar over the bed of the lathe shown in Fig. 72 operates such a clutch. The start and stop push button of the automatic controller is shown at the left side of the bed, in front of the change gear box, while the controller is mounted inside the hollow right front leg. It would be better to have this leg open out and possibly with a door, so that the controller would be readily accessible. Fig. 74 shows a phantom view of the motor and driving belt. When so arranged, a shunt-wound d.c. motor or a standard a.c. squirrel-cage motor are very satisfactory. The controller may be any form of inexpensive automatic manual or automatic starter, although it is preferable to use a starter providing low-voltage protection.

For a constant-speed d.c. motor, an inclosed face-plate type manual starter, with a fused safety line switch comprise a satisfactory and inexpensive equipment.

For a.c. motors up to and including 5 hp., unless undervoltage protection is eliminated, the small "across-the line" automatic starter with thermal cut-outs and push-button control costs less than an equivalent manual

The ninth article. The tenth will appear in an early issue.

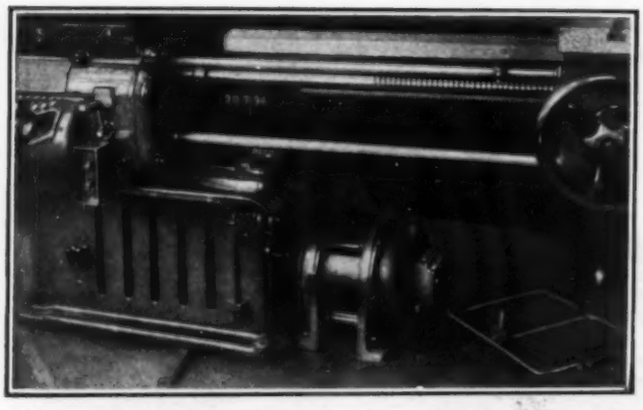


Fig. 73—Removing the motor from the lathe pedestal

starter. Above 5 hp., a resistor or a compensator-type starter are desirable, although not absolutely necessary in a shop having a large connected load. A compensator or a resistor-type starter are primarily used to limit the current inrush, as squirrel-cage induction motors in the sizes used on machine tools may be started by connecting them directly to the line without damage to the motor. However, unless the horsepower of the motor in question is but a small percentage of the load on the individual transformer or feeder, the current inrush at starting will cause undesirable voltage fluctuations on the entire system which may be so severe as to trip the undervoltage relays of other motors on the same circuit.

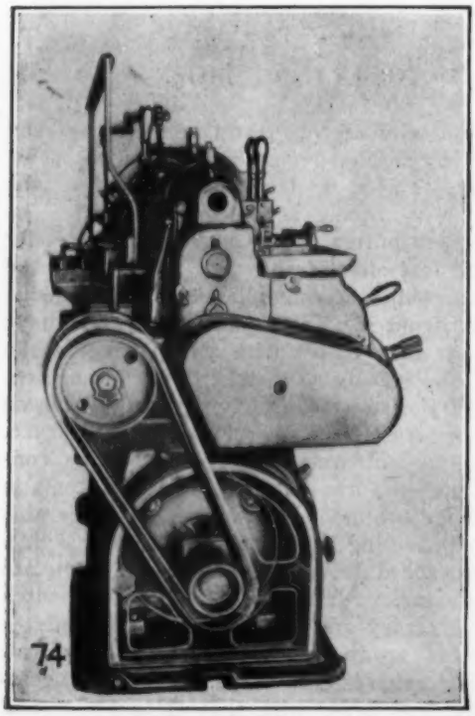
When the motor is completely inclosed in the pedestal, as in the machine shown in Fig. 72, care should be taken to provide proper ventilation in order to prevent overheating. Ventilating holes should be located so as to protect the motor from chips, dirt and cooling compound, as well as to insure an uninterrupted draft of air through the motor. It should be remembered that the air circulates *through* a motor; consequently, if even one end of a motor be completely inclosed, the motor will not be able to deliver its full rated horsepower without overheating.

The full advantages of motor drive cannot be fully realized with a constant-speed d.c. motor used as above. An adjustable-speed motor may be used, and thus make it possible to eliminate the clutch and a number of the gear changes. When so used, the motor is started and stopped either by a drum controller, which also acts as a field rheostat to adjust the speed, or by an automatic controller operated by a push button at some convenient location on the head and with a field rheostat at the headstock for adjusting the motor and consequently the faceplate speed. With such an equipment the motor is directly coupled to the lathe with no friction clutch intervening and the motor runs only when the lathe is used. The motor is stopped by dynamic braking, and there may be any reasonable number of speed points between the few obtained by gear changes. Such a machine is more convenient to operate than an all-geared machine, but many lathe builders prefer to concentrate on the type first described to avoid the necessity of manufacturing two different drives for the same lathe.

When a.c. motors must be used, a four-speed squirrel-cage induction motor could be selected, with a drum switch for changing speeds as on the lathe shown in Fig. 75. In addition an automatic controller could be employed, if desired, to start and stop the machine.

In Fig. 76 is shown a 21-in. lathe driven through a short belt by a motor bolted to the back of the bed and controlled by a primary-resistor type reversing drum. This mounting of the controller is not to be recommended because of its inconvenience. The controller should preferably be operated from the carriage by means of a spline shaft. Where this is impracticable, it should be mounted on the head so that the operator need not move any distance from the operating position to reach the handle.

With larger lathes, the bed is usually so long that some form of control from the carriage is desirable. In



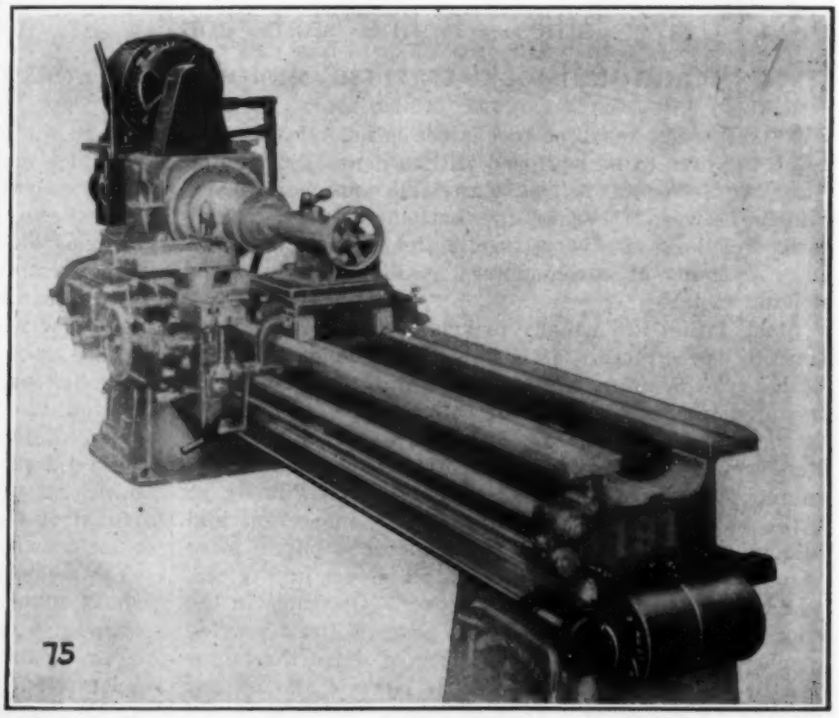
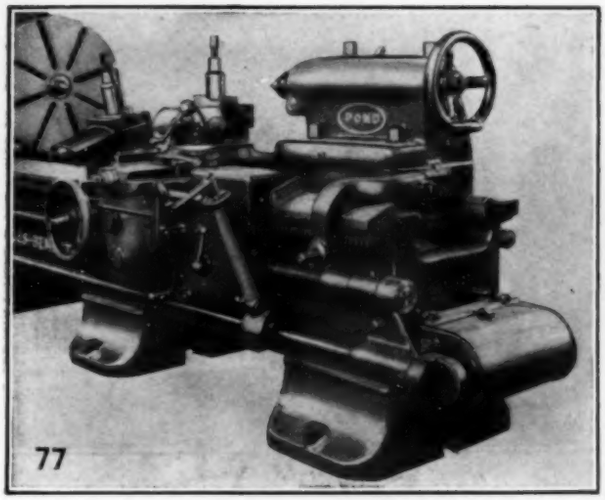


Fig. 74—Phantom view of motor driving a lathe. Fig. 75—Four-speed induction motor with controls mounted on lathe



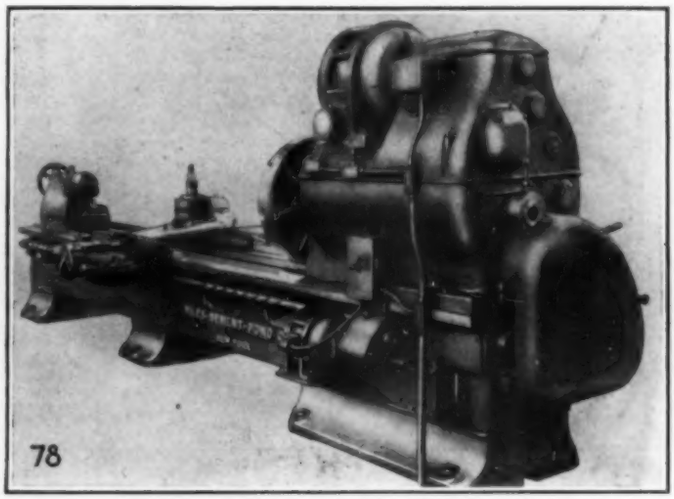


Fig. 77—Drum controller operated through a spline shaft. Fig. 78—Lathe with a.c. motors and controls

some machines this is obtained by means of a spline shaft operating the friction clutch before mentioned. The more usual way is to start and stop the motor either by a drum controller operated from the carriage through a spline shaft, or by an automatic controller with a master switch that in turn is actuated from the carriage through a spline shaft. In Fig. 77 is shown such a drum, together with the connecting spline shaft, and the operating lever on the carriage. With this construction, full control of starting, stopping and, if necessary, reversing, is obtained from the carriage. This arrangement is very desirable, as it concentrates all controls of the machine at the point where the operator should normally stand while running the lathe. With d.c. machines the drum controller, in addition to starting the machine and stopping it by dynamic braking, would act as a field rheostat. Consequently when such equipment is used, the operator may adjust the faceplate speed over quite a wide range without moving from the carriage.

With a.c. driven machines in which no dynamic braking is possible, there is frequently a mechanical brake actuated by the same spline shaft that operates the master switch. This brake brings the machine quickly to a stop as soon as the power is disconnected. Fig. 78 shows the electrical equipment of an a.c. driven lathe very clearly. The three-phase squirrel-cage driving motor is directly coupled to the shaft carrying the driving pinion. The small box to the right of this motor is the master switch, operated from the carriage by the same shaft and gearing that operate a mechanical brake in the head and control an automatic, primary-resistor type controller such as was shown in Fig. 44. This controller provides overload protection by means of a thermal relay, while the connections in the master switch are such as to give undervoltage protection. Automatic, reversing a.c. controllers are usually special, and can seldom be obtained on short deliveries. For this reason it may be necessary to use a drum-type controller where a reversing a.c. drive is necessary, although an automatic controller is preferable.

On large lathes, small motors are frequently provided solely to traverse the carriages or the tailstock. There are two entirely different methods of accomplishing this traverse. A small motor may run continuously, driving either a spline shaft or a shaft having two threads pitched in opposite directions. This shaft is mechanically connected to the traverse mechanism in such a way as to operate the carriage in the desired direction. Fig. 79 shows a traverse mechanism of this sort driven by a compound-wound d.c. motor having an inclosed manual faceplate starter. Such a traverse motor should be wound for constant-speed operation, should have a high running torque, and should be adapted for continuous operation. A standard squirrel-cage a.c. motor, or a standard shunt-wound d.c. motor are particularly suited for this service. Any simple manual starter is satisfactory unless, as sometimes is the case, the oil pump for the machine is driven from the same motor that drives the carriage. In such a case it might be desirable to use an automatic controller so connected as to start the traverse motor when the main motor starts. It might be preferable to start the traverse motor from a separate push button, with the connections so arranged that the main motor cannot be started until after the oil pump motor has started. In any case it is desirable to provide overload protection for the motor. Undervoltage protection is unnecessary with a traverse motor.

On most large lathes, the carriage and, at times, the tailstock are traversed by small motors that run only when it is desired to move a part of the machine. Such a motor may be rated on its maximum starting torque

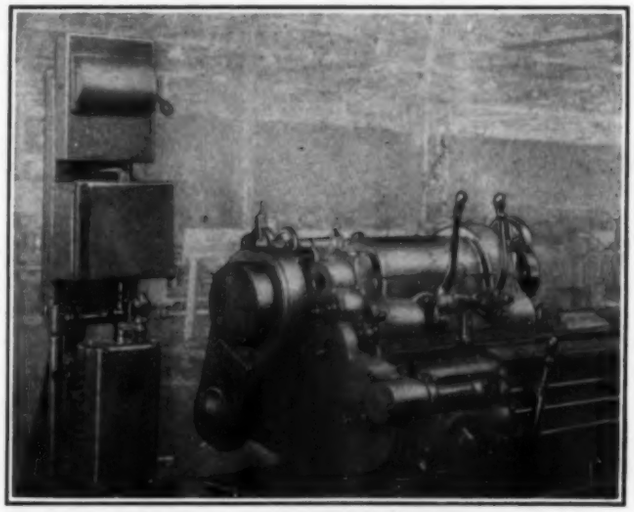
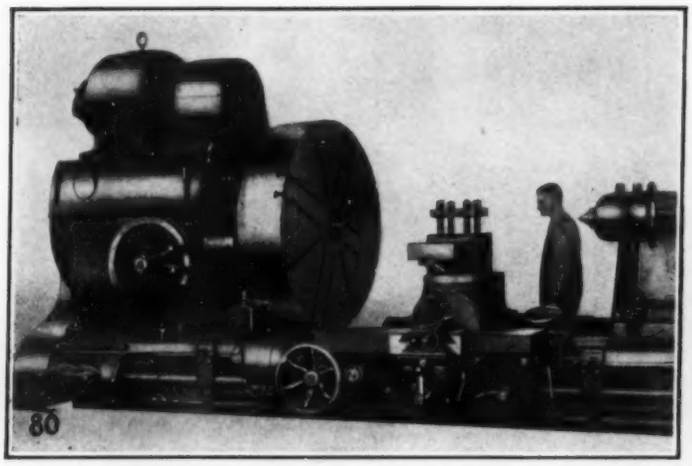


Fig. 76—Primary-resistor type controller for 21-in. lathe



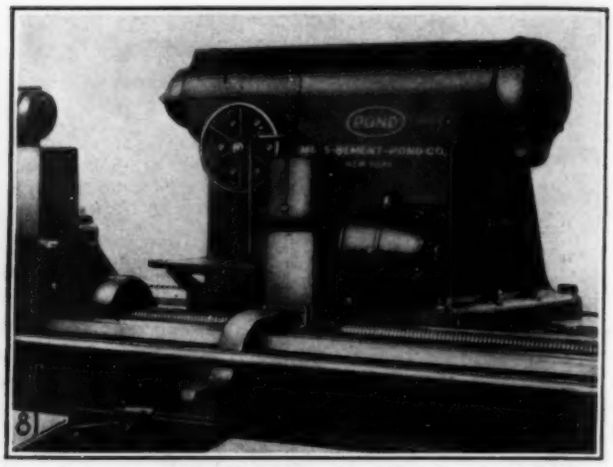


Fig. 80—Traverse motor on a 60-in. lathe. Fig. 81—Tailstock traverse mechanism on 113-in. lathe

or on its commutating capacity, and given a short time rating, usually on the basis of full load for 5 minutes, with a temperature rise of 50 deg. C. Motors having commutators, whether d.c. or single-phase a.c., should be completely inclosed to keep chips and coolant out of the motor while the machine is operating, and to keep the motor free from dust while it is idle. Fig. 80 shows a 60-in. lathe driven by d.c. motors. The traverse motor, which is mounted at the left of the carriage, is fully inclosed. The drum reverse switch is mounted directly above the motor, making it very convenient for the operator.

Alternating-current motors used for this service should be of the high-torque, squirrel-cage type with a simple drum-type reverse switch having a spring return to neutral, and having fuses or thermal cutouts to protect the motor.

Direct-current motors for traverse service may be either series or compound wound. They should be series wound if the motor is solidly connected to the traverse mechanism, and compound wound, preferably with a series field of about 40 to 50 per cent if the motor is mechanically connected to the traverse gearing by means of a clutch or similar device. Either type of motor is best controlled by a small reversing drum controller having spring return of the handle to neutral. For d.c. motors, the drum preferably should have at least one step of starting resistance to limit the current inrush at starting. This provision is desirable not only to protect the motor, but also to make it possible to jog the carriage along when bringing it to a desired position. If the motor is started by connecting it directly to the line, there is a tendency for the carriage to jump an inch or two, even when the drum is only operated momentarily. It is preferable to have enough starting resistance at the first point so that the motor will just start the carriage.

The same consideraions apply to rapid power traverse to lathe tailstocks. In Fig. 81, the traverse motor and controller for the tailstock of a 113-in. lathe are shown.

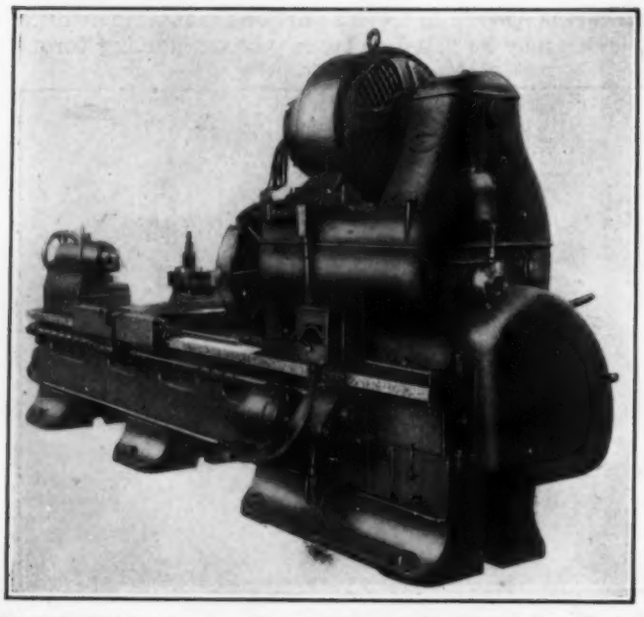


Fig. 79—Carriage traverse motor and controller on lathe

Service of Air-Driven Tools

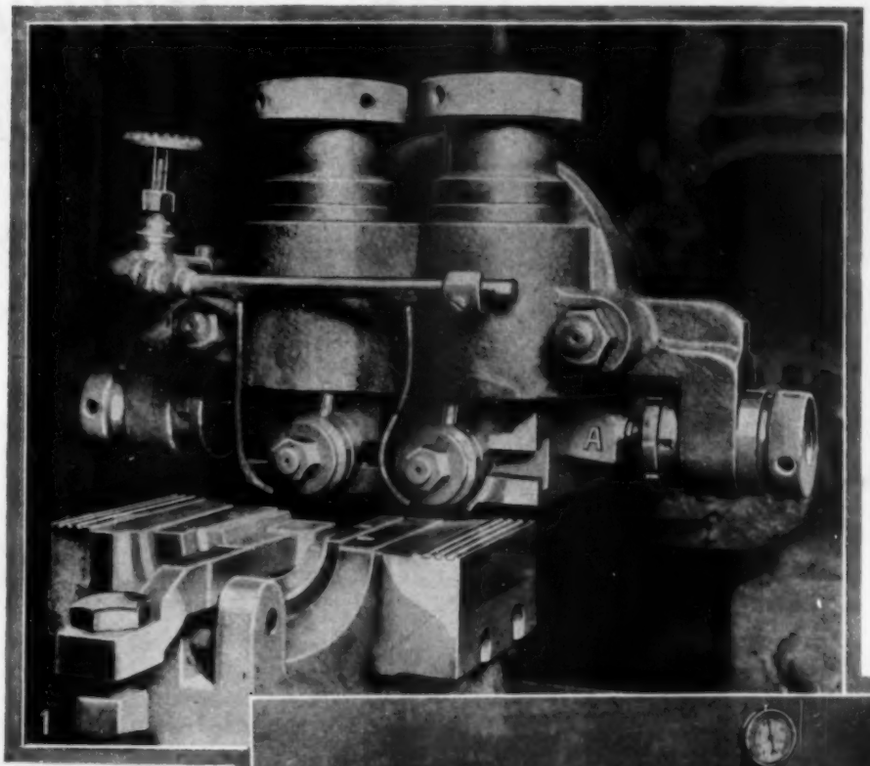
By August Jeffers

LEAKY pipes and fittings may increase materially the cost figure for compressed air. It is always a good policy to examine the piping layout periodically to insure against leakage, and assure to the tools a supply of clean, dry air. Dry air is one of the chief points to emphasize in an installation, as the tools will be affected in speed, and the moisture will cause rapid wearing of parts, sticky valves, and in many instances corrosion.

Clean air, that is, air free from dust particles, can be obtained by guarding the intake with air filters, and by setting this air intake away from dust accumulations. It is good practice to install after-coolers near compressors, to cool the air below room temperature. This is necessary to precipitate moisture. No drains of the hand-controlled variety should be installed on these after-coolers, but such drains should be automatic in operation.

The pitch of the air line should be sufficient to insure ample drain with the air flow, and there should be as few turns as possible. It is very important to see that the branch lines are taken off of the main lines vertically and always upwards. Small receivers for the collection of water should be distributed along the lines. The best practice calls for automatic drains on these receivers. Our experiments show that reheated compressed air, especially in small plants, gives economical results because of the greater volume that is available for use.

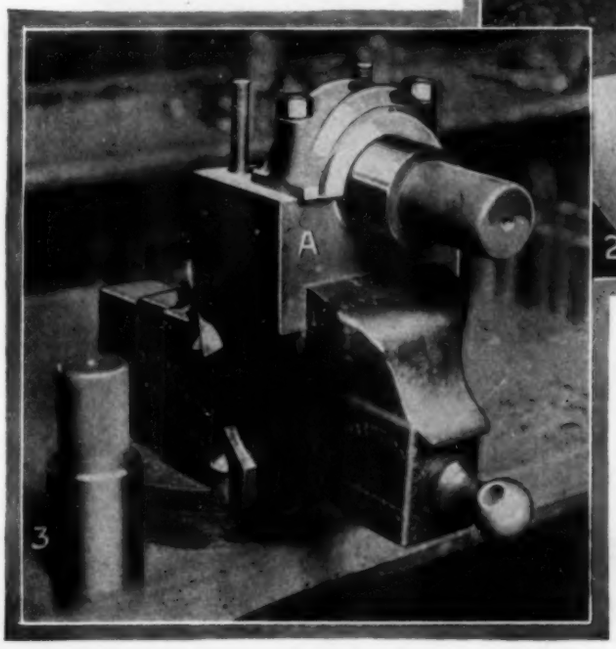
Marmon Main Bearings



1—Diamond tool for machining joint between two halves of main bearing. Note micrometric method of adjusting tools by means of wedge A

Photographs by courtesy of the Marmon Automobile Co.

2—Surface plates to determine if joints of bearing are parallel, and an amplifying gage to test the accuracy of the radius of the bearing in relation to the bearing joints



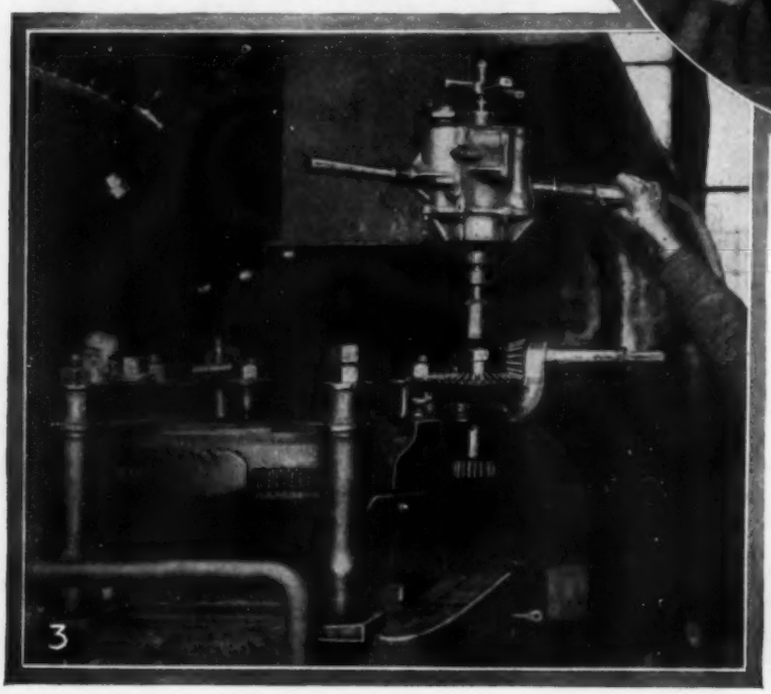
3—Plug gage and dummy block A, *to inspect bearings for oil film clearance. Clearance is held to within 0.003 inch*

Portable Motors in Railway Work

1—Driving valve setter with an air drill — Kingsland shops, Lackawanna Railroad

2 — Drilling trailer wheels for hub liners—Sayre Shops, Lehigh Valley Railroad

3—Air-driven valve-facing machine— Sayre Shops, Lehigh Valley Railroad

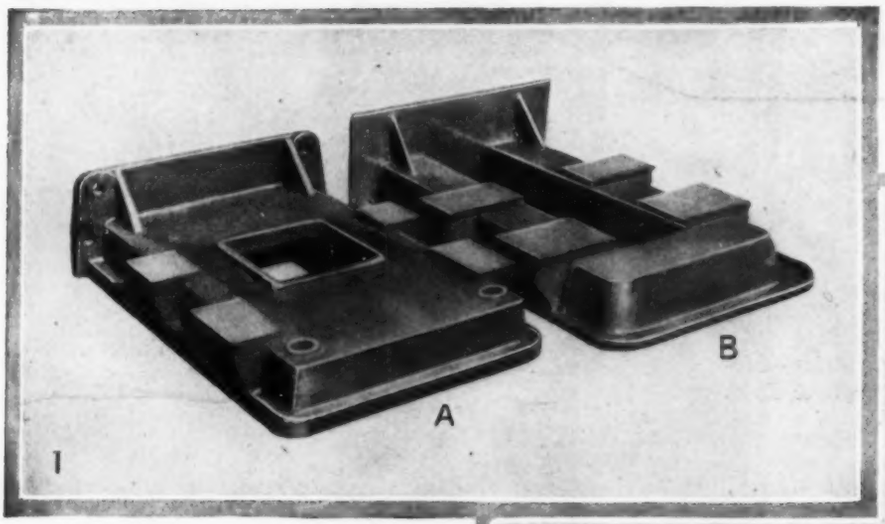


4—Boring valve chambers—Sayre Shops, Lehigh Valley Railroad

5—Boring bar with all-gear drive—McKees Rocks Shops—Pittsburgh & Lake Erie Railroad

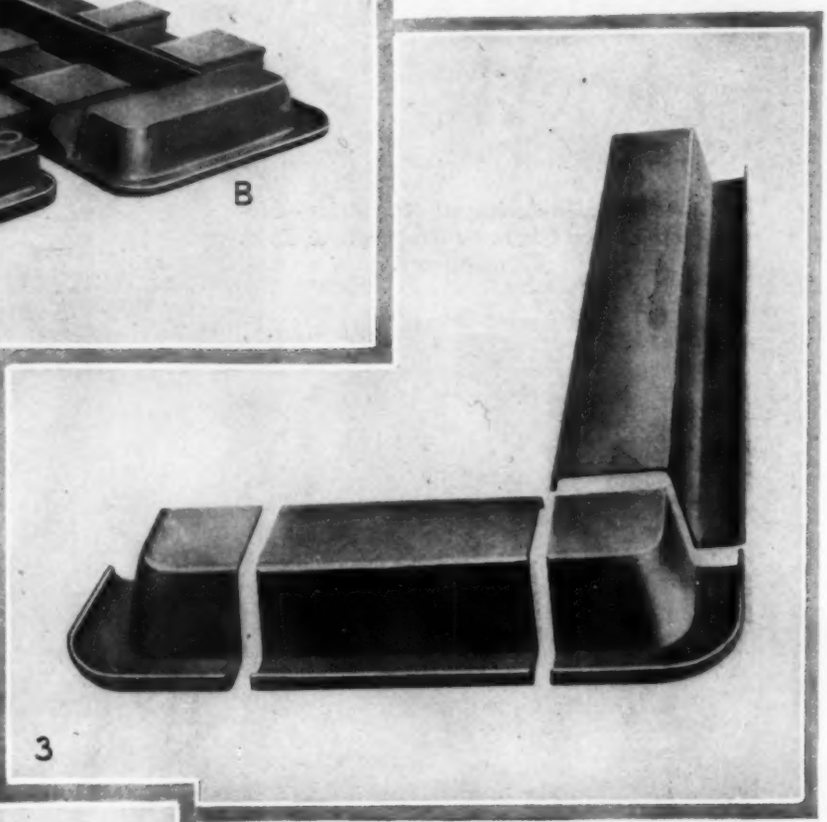
6—Boring bar with belt and gear drive —Sayre Shops, Lehigh Valley Railroad

Photographs by courtesy of the Ingersoll-Rand Co.



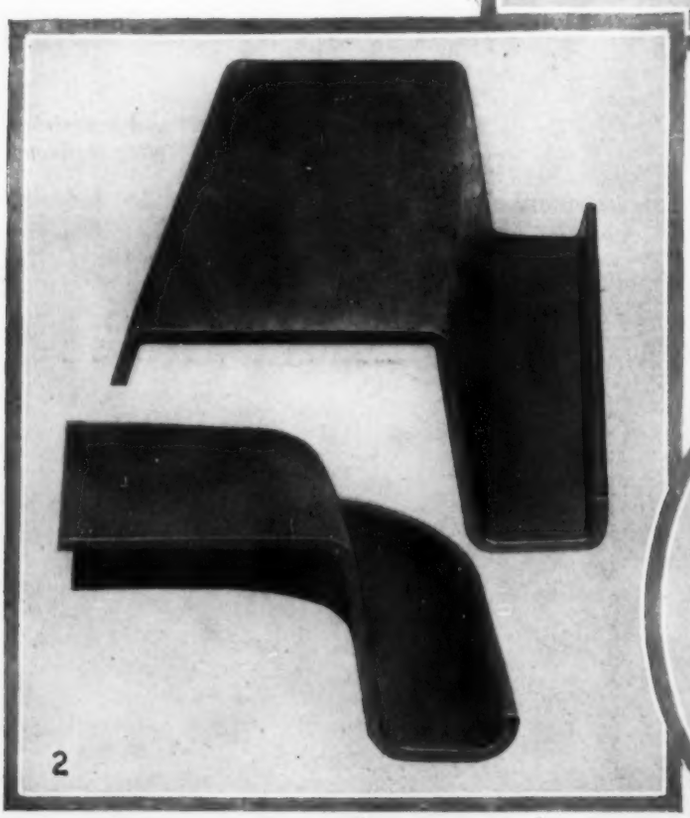
1—At A is a typical cast-iron base. It weighs 184 lb. and cost $11.04. At B is an equivalent base, arc welded from steel sections. It weighs 109 lb. and cost approximately $5.50

Machine Bases *of* Welded Steel

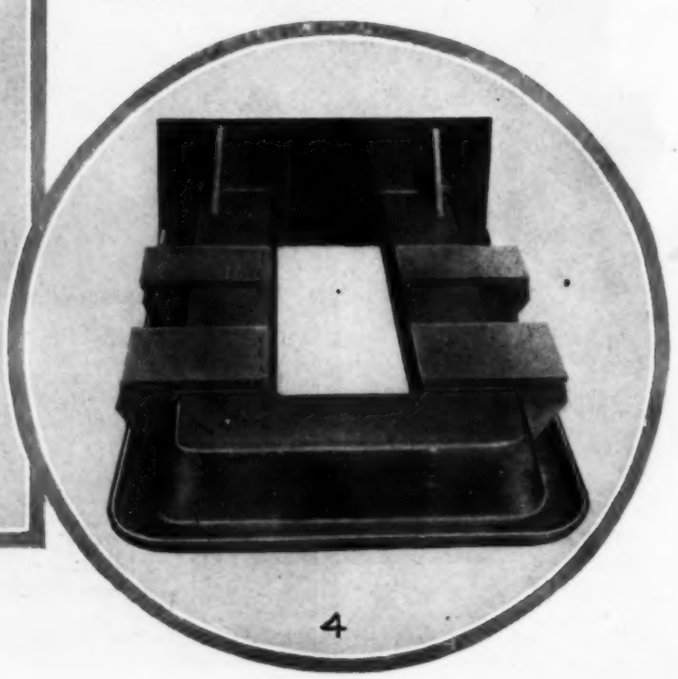


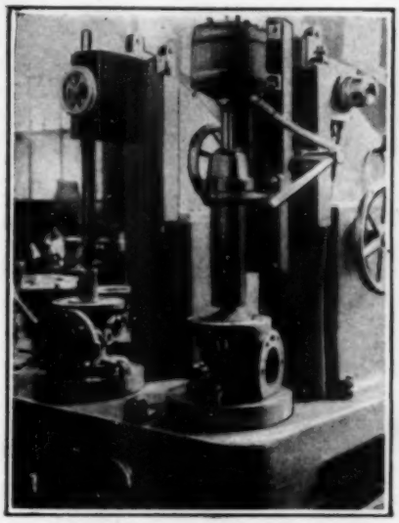
3—Loose assembly of sections. Corners and intermediate sections are standard. Intermediate sections can be of any length desired

4—Completed base showing the welded seams. Gussets, pads and angles can be attached wherever needed



2—Standardized steel sections for use in fabricating machine bases by arc welding





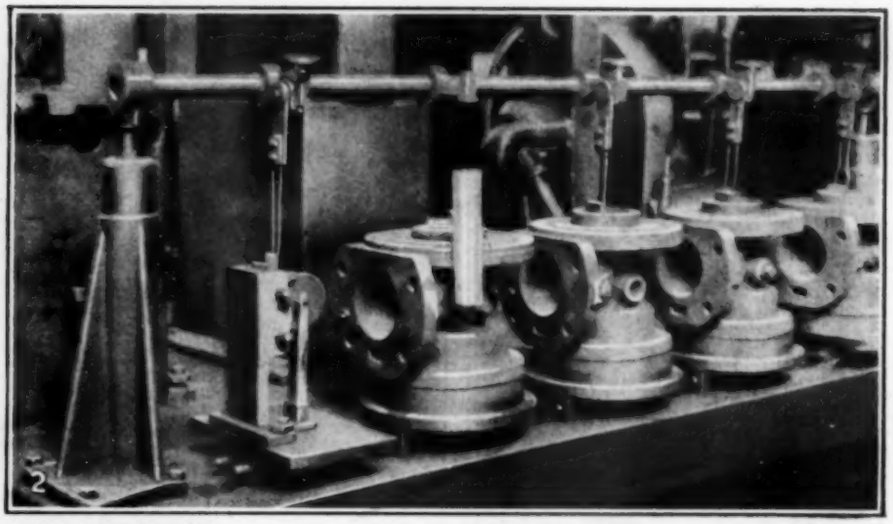


Fig. 1—Grinding and lapping cylinders of triple-valve bodies. Fig. 2—Lapping slide- and graduating-valve seats

Air-Brake Equipment Reconditioned by Modern Devices

By Frank W. Curtis
Western Editor, American Machinist

INASMUCH as a triple valve is one of the most important parts of air-brake equipment, the Denver & Rio Grande Western R.R. Co., Denver, Colo., takes precautions in handling the repair work necessary in reconditioning this unit so that its positive operation in service will be assured. The repair work is routed to a department handling air-brake equipment exclusively, located on the balcony of the machine shop, where machine equipment is available, thus avoiding the necessity of sending work to other departments to be machined.

Triple-valve parts are reconditioned in the Foster semi-automatic valve-finishing machine, illustrated in Figs. 1, 2 and 3. The machine is composed of several individually-operated units mounted on a base. Worn triple-valve bodies of the bushed type, have their cylinder bores reground and lapped when the thickness of the bushing permits, otherwise, new bushings are fitted into the body. In both cases, however, the cylinders are finished to size as shown in Fig. 1. To the right is to be seen a vertical grinding unit in which the valve body, having a 3½-in. cylinder bore, is clamped to a revolving table positioned in correct relation to a spindle carrying an abrasive wheel. The work revolves at a speed of 70 r.p.m., during which the spindle is given a reciprocating motion in accordance with the length of the work. In grinding new bushings, the bores are ground to a plug-gage fit. Boring is not required, since the bushing when fitted into the body, is made close to size with only the necessary stock allowance for grinding to the required dimension. The abrasive wheel is kept in condition in the usual manner by means of a diamond truing tool.

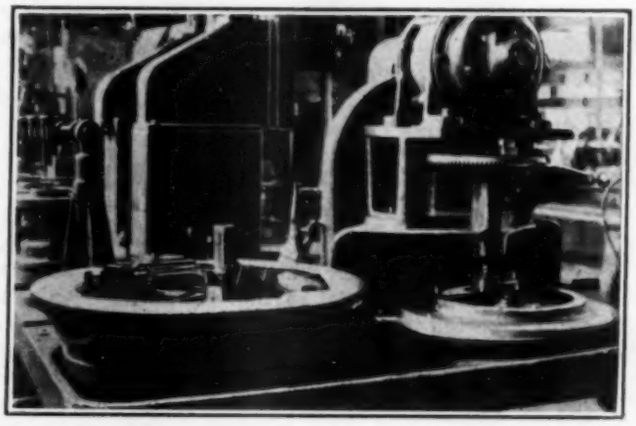
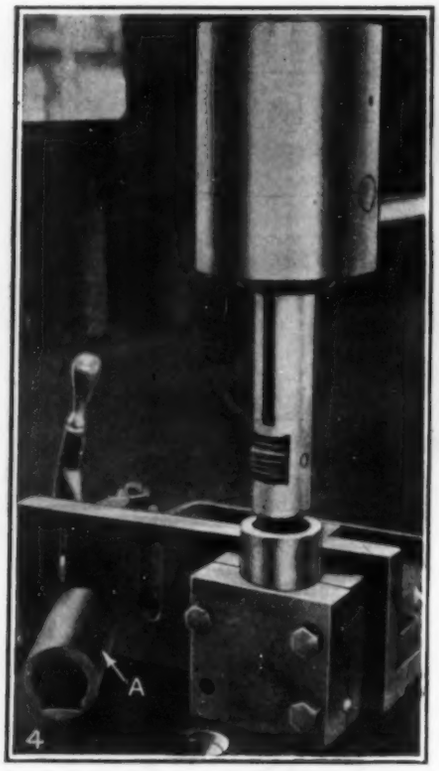
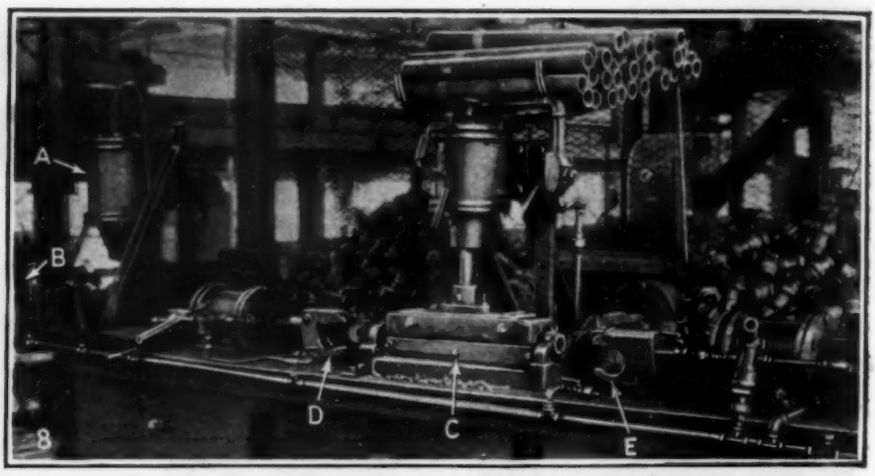


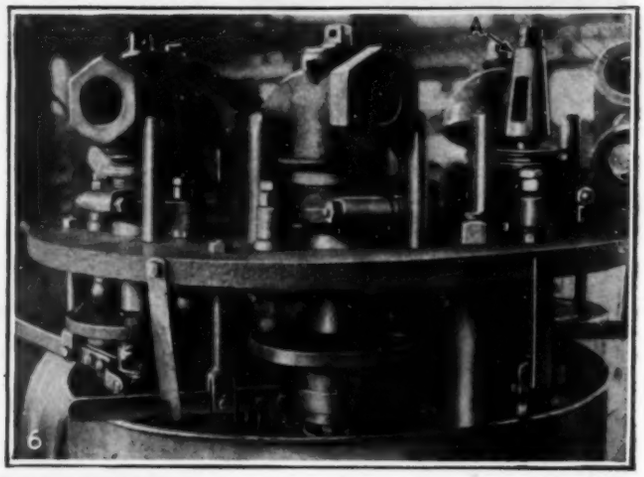
Fig. 3—Rotary lap for slide valves and graduating cocks

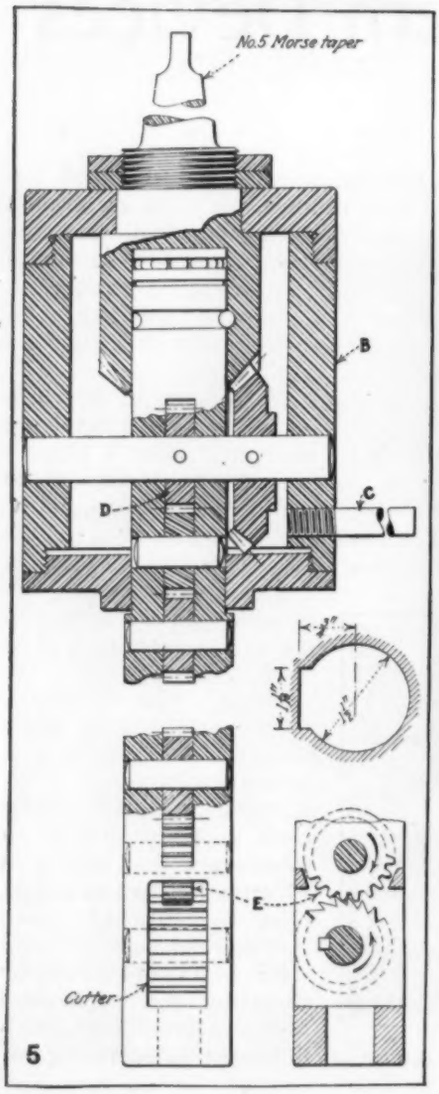
To the left is shown a unit for running in the rings to the cylinder bore. The work, clamped to a revolving table operating at 6 r.p.m., is located under a plunger to which is connected the piston and the rings to be used with the valve body. The plunger reciprocates at 60 strokes per min., the action being the same as in honing cylinders. Oil, applied to the contacting surfaces, is used as a lubricant. The grinding and the running-in operations both require about 1 hr., but since the machine is semi-automatic, but a fraction of the operator's time is required, thus permitting him to give his attention to such operations as assembling, or to other work that may need his attention, such as assembling reconditioned valves.

Slide-valve bushings have their seats lapped by mounting the triple-valve body on a fixture over which is located an operating bar









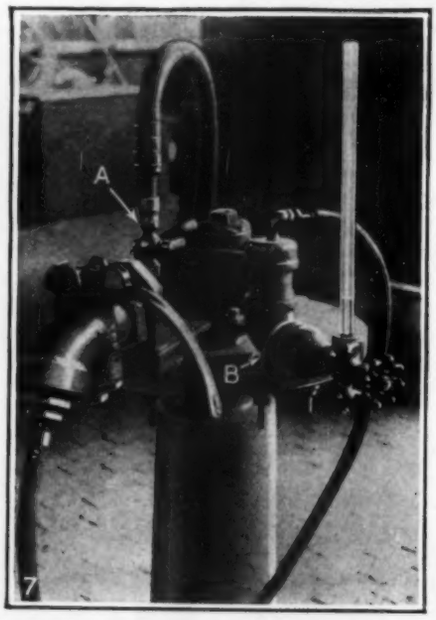


Fig. 4 — Milling tool for slide-valve seats

Fig. 5—Constructional details of milling head

Fig. 6—Automatic machine for reseating angle cocks

Fig. 7—Testing unit for reconditioning angle cocks

Fig. 8—Air-hose stripping and assembling machine

as shown in Fig. 2. A lap (resembling the slide valve) is placed in the bushing, where it is held in tension by a flat spring. It is connected to the bar by a wire arm so that the oscillating movement of the bar will reciprocate the lap. Approximately 15 min. are required to complete the operation. Fine garnet is used as a lapping medium.

The fixture accommodates four valve bodies. To the left is to be seen the fixture arranged to lap graduating-valve seats. The work is held in place and is connected to the operating bar in a manner similar to the preceding operation. Lapping is accomplished at 120 strokes per minute. The individual laps can be disconnected without stopping the machine.

Slide valves, blow-off cocks and graduating valves have their faces lapped by a flat rotating-lap on which the work is placed as illustrated in Fig. 3 at the left. The plate revolves in one direction while the work carriage, comprising a sheet-metal disk cut out to receive the work, travels in the opposite direction. The carriage is used merely to drive the work, which rests on the lap and is given grinding pressure by its own weight. The carriage and the lap revolve eccentrically to one another, so that the lap will be worn equally on all portions. No. 00 Carborundum, mixed with kerosene, constitutes the lapping medium. Lap sticks, used for lapping slide-valve bushing seats, are kept in condition by having their contacting faces lapped by this unit.

Three laps are utilized in connection with the machine, two of which are lapped to one another as illustrated to the right. The lower plate remains stationary and the upper one revolves over it in an irregular path. The respective positions of the plates are changed daily so that each plate is used only every third day.

Ingenious Milling Job

Few railroad shops are equipped with broaching machines, therefore, the milling of seats in slide-valve bushings presented a problem that was solved by the tool shown in Fig. 4. The work is held in an adapter mounted on an angle plate in the drill press. The milling head, connected to the spindle, has a cutter mounted at its lower end, the cutter being driven by a train of spur gears, operated by the machine spindle through bevel gears. A finished bushing is shown at *A*. In Fig. 5 is a diagrammatic layout of the milling head. The body *B*, restrained from turning by the pin *C*, houses bevel gears that drive the gear *D*. Through this gear is driven a number of idler gears and the driven gear *E* that operates the cutter. The work is 4⅛ in. in length, 1½ in. inside diameter, and has a 1 7/16-in. wide slot milled to a ¾ in. depth at the center. The cutter is operated at 120 ft. per min., and the feed is 0.006-in. per revolution.

Angle cocks to be reclaimed are first stripped, then cleaned in a solution of gasoline, after which they have their seats ground in the automatic valve-grinding machine illustrated in Fig. 6. The plug is attached to one of the spindles of the machine, as shown at *A*. The spindle revolves at 100 r.p.m. The cock body, placed over the plug, remains stationary with the exception of a slight vertical movement, controlled by a face cam that raises the body twice during each revolution of the spindle. The machine has six spindles, each of which is equipped with an individual clutch. Fine Carborundum is applied as a grinding medium.

After re-assembling, angle cocks are tested in the device illustrated in Fig. 7. The cock is screwed to an angleplate adapter to which the air connection *A* is attached. The opposite end of the cock is fitted with a reducer to which is attached a hose that connects with the reservoir *B*. If air applied to the cock passes through the plug to the reservoir, the water in the glass gage will bubble, indicating that the cock leaks.

In Fig. 8 is illustrated an air-hose stripping and assembling machine that is operated by seven air cylinders. The clamp bolts of the hose assembly are severed by a shear connected to the cylinder *A*. Then the clamps are spread by the unit *B* comprising two jaws that are separated by a connecting cylinder mounted under the table. In this condition, the hose is clamped as shown at *C*, after which the two jaws *D* and *E*, pulling in opposite directions, strip the coupling and the nipple. A new hose section, fitted with a clamp at each end, is clamped in the same manner and then, by attaching a plate to the stripping jaws, they are used for pressing the fittings into place. The hose clamps are drawn together by two plungers connected to individually-operated air cylinders mounted at the rear of the clamping attachment. New bolts are assembled by hand, completing the unit. The device illustrates a well-combined group of units, conveniently controlled, and efficient in operation. An old hose can be stripped and a new one refitted in approximately 2 minutes.

Recognizing a Precedent

By L. J. Yapp

IF THE average man were asked to name the qualifications of an executive he would promptly respond with a long list of such attributes, but there is one he would seldom mention. If he did, he would undoubtedly designate it as "creating" a precedent. It is obvious that any good executive would give considerable thought to a question if it were put to him to create a precedent by his decision. But the important thing is to recognize a precedent as a possibility of any decision rendered.

The executive who will weigh a decision not only in terms of its immediate application, but in terms of its relationship to allied decisions rendered in the past or likely to be demanded in the future, is building up the structure of his executive career on a firm foundation. It is so easy to solve a question with the first plausible answer that arises, that this is a phase of executive authority and responsibility that often is greatly underestimated. But the decisions of today, whether the executive wills it or not, are bound to form the precedents of tomorrow in any shop or business. If these do not follow a logical predetermined line of action, the executive is bound to find himself the center of a thousand and one petty questions arising constantly for his decision. So the "busy" executive is often born unwittingly to no real purpose. He is eternally deciding this, that and everything, yet for all his haphazard energy, he does not find his production equal to that of his fellow executive who always seems to have time for creating new methods and organizing his department more efficiently so as to get an ever increasing production.

If an executive hopes to progress, he must establish definite trends and policies early in his career, and as far as is consistent with good judgment, stick to them. Thus by recognizing precedents in advance, he will have established definite lines of action to be followed, and will actually have time to do the real work of an executive—the modification or setting aside of rules and precedents when the circumstances demand it. Thus he will have built a real organization which can continue to function in his temporary absence on the basis of the precedents he has forehandedly created, and will not immediately go to pieces in such a circumstance. Many a man's chance for a big promotion has been lost simply because his superiors could not conceive of his department functioning without his being there to direct its every little detail. This situation when it exists is in a great part due to his department never having been organized by precedents.

THE · FOREMAN'S · ROUND · TABLE

How Do Mutual Aid Societies Help?

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"TOO BAD about Tony Mixter, Ed. He's a nice sort of chap and he's playing in hard luck."

"What's the trouble, Al?"

"Why, Tony has been laid up with the grippe for about ten days—and I know he isn't any too flush with cash, after the new youngster and all. Seems to me, Al, we ought to have some sort of a fund that would help out on a case like that."

"Guess you're right, Al, but how? We could pass the hat, of course, but no one likes that. Everybody would feel compelled to give, and that's a serious objection. Then Tony wouldn't like it, either."

"No, Ed, passing the hat is a relic of bygone days. We ought to have some fund that would help out in cases like this."

"The group insurance policy ought to cover sickness, too, Al."

"Can't very well, as it's run now—premiums would cost a lot more for the company. We may come to that some day, Ed, but in the meantime we ought to have a way of looking after such cases as Tony's. If he had been hurt he'd be looked after, but that doesn't help matters any."

"What about some sort of a mutual aid arrangement, Al? They've had one over in Johnson's shop for a long time. The men pay in ten cents a week and anyone who is laid up gets $10 a week—and seventy-five dollars if he don't get well."

"Does everyone join, Ed?"

"No, it's voluntary—but most of them do. After an epidemic of flu they flock to join and then some drop off again as the general health improves. But most of 'em stick year after year and it's been a great help to all hands."

"Who runs it, Ed?"

"The men themselves, Al. The firm has nothing to do with it. I believe they did chip in to help boost the treasury during the last flu epidemic—but that's all. It seems to work out fine, Al. Why not start one here?"

"Sounds good to me, Ed—let's talk it over with Williams—I believe he'll be for it—let's ask him."

Mutual Aids are working well in many plants. Have you one and how does it work in yours? What are the objections, if any?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Shop Visiting for the Foreman

A FOREMAN who is privileged to visit other establishments as a means of education should be considered fortunate. He is afforded first hand opportunities to observe methods of production which differ from the methods he uses. As a result he is subjected to a broadening influence, not readily acquired in any other way. His experience in seeing how other plants manage their departments, from the handling of the raw material to the disposal of the finished product, will do much to acquaint him with the task confronting other departmental heads. His viewpoint will have been shifted from his own difficulties to the problems confronting others, and he is moved from the position of spectator, where his scope of vision widens accordingly. Mingling with other men in his station of life, he is subjected to the influence of different personalities. He witnesses the actual methods of production of others with their various "tricks of the trade." Many things directly usable or adaptable for use in his department will no doubt be noted and put into use when the occasion presents itself. One other thing is that he is furnished with a basis for comparison. The average man in his situation will be quite apt to raise the questions: "Why can't I keep my department as efficient appearing as Mr. Brown's," or, "Why is my crew such an untidy lot," or, "How does Smith inspire such respect among his men?" When a man thus realizes his own insufficiences he is quite apt to set about remedying them. Thus the foreman is given the practical means for mental growth, and the one receiving a large share of the results is the company which employs him. —H. K. FLECKNER.

Who Should Do the Discharging?

NO SET rules can be handed down for discharging employees; each case should be handled according to its merits. In some cases it is to an advantage to "fire" a man and let the entire works know why he was dismissed. However, no employee, regardless of his offense, should be dismissed without a fair investigation, even though it be an aggravated case. Many foremen have discharged employees during a moment of anger and later felt they had been too hasty.

Oftentimes, cases arise where an employee will break some rule when he is not entirely to blame, but which would necessitate letting him go. If he has been a steady employee who has not given any trouble before, he should be given the privilege of resigning in order to help him on the next job.

The foreman directly over an employee to be discharged, should at all times have the final word as to whether or not an employee should be discharged. In the event that he does not have the final word, the employees soon begin to feel that he is merely a fixture and carries no authority. If a foreman is to be foreman, let him be foreman. —JOSEPH HOWARD.

THE · NEXT · TOPIC

Foremen's Clubs

QUESTIONS

Have you a Foremen's Club in your city?

What subjects does it discuss?

Have you found it of value in helping to solve your problems?

Who Should Select New Equipment?

THE important thing in the selection of new equipment is to segregate the facts from the prejudice and bias of the men. Too often the man who swears unqualifiedly and fervently by a certain machine does so chiefly because he knows only that particular machine through experience, and is consequently afraid of the unknown. So if you can get real facts from the men, they should by all means be given due consideration, but be certain they are facts. It is also important to guard against the tendency of the men to "play safe" and to recommend the best and most complete type of precision machine they know of in the given line of machinery, which would often lead to the purchase of a more expensive machine than the type of work to be done on it would warrant. I believe the plant superintendent should have the final say under all circumstances, for he alone has a comprehensive knowledge of the needs of the plant as a whole. To do otherwise would often lead to the over equipment of a given department, simply because it has an aggressive foreman or one who continually claims he could do better if they'd only give him the "right" equipment.

Then too, the plant superintendent is in the best position to guard against the purchase of too much "special" equipment. No doubt the special equipment can save time on a given operation, but it is important to know whether there is sufficient current special work and the promise of its continuance before purchasing a machine which may become a "white elephant" if the particular work should cease. —A. A. CROWELL.

Should Foremen Accept Presents from Their Men?

WHEN a foreman is leaving a factory where he will not come into contact with the men who have been under his charge; and he has held their genuine respect and co-operation, the acceptance of a gift from them is not out of place. They will take pleasure in having their associate take away with him some token of their mutual friendship.

A foreman of the right type, whose relations with his men are straightforward, need feel under no obligation in accepting a present from them. If he has kept his responsibility clearly outlined before them they will

realize that the strict enforcement of rules by him is his part of the job, and will only result in their permanent welfare.

However, granted that a foreman's relations with his men are ideal, the fact still remains that he is in a better position, financially, to give them presents than they are to give to him, and the obligation for him to do so is just as great. A custom, once started, establishes a precedent that is hard to break, and the relationship between the foreman and his men may change to such an extent that the giving of a present is more of a farce than a token of regard. It is bound to become an obligation rather than a pleasure, and should be discouraged. —H. G. BAYLEY, *Foreman.*

FOURTEEN years as a foreman has taught me not to accept presents from employees. My most prized gift from former employees, when leaving them for a better position, was a neatly written letter with about fifty names signed, setting forth their sorrow for my leaving them, and hope for my success in the higher position. I would suggest to all foremen to be satisfied with such gratitude from their help, and live with a clear conscience, with no regrets when hard times come.
—JOS. L. MIHOLICH, *Foreman.*

THE giving of a present to a foreman does not in any way place the foreman under obligation to his men, although he has that feeling. The average man also expects special favors, especially the one who has made preparation for the occasion.

It is also a fact that at least two-thirds do not give with a good will; they give to keep from being called tight wads, as they are not men enough to stand up to their conviction. Then they make insulting remarks about the man who takes up the collection, thinking he wants to stand in with his foreman.
—WM. B. WESSELS, *Chief Inspector.*

Making Good Workmen Out of Poor Prospects

MANY good workmen have been developed out of men who appeared to have poor prospects. I have found men placed in positions in which they would never make good, no matter how or what time had been spent on their training. It is best for this type of man, and for the firm, to move him into another department, but in doing so the foreman should explain to the man the reason for his transfer, and show him his other chance to make good.
—C. L. HENRY, *England.*

Which Kind of Man Is More Valuable?

A MAN who hunts up the foreman is not always trying to stand in. In most cases it is genuine interest that he places in his work. It may be a case of trying to play safe when he lacks confidence in himself. But sometimes it is because he likes to talk to his foreman, which makes him a pest.

A man who obeys orders blindly, without thinking or caring about the result, cannot be considered a desirable man. But on the other hand he may have a foreman who is very stubborn, will not allow his men to suggest to him, or allow mistakes to be shown. The type of man who earns most for the shop is the man who will check his work with the blueprint, and if an error is found, call the attention of his foreman to it. Men should co-operate with the foreman, and help him avoid errors. Oftentimes the foreman's mind, being very much occupied, may cause him to err in handing out work. He needs assistance from his men.
—WM. B. WESSELS, *Chief Inspector.*

IN PRACTICE we find two extremes in workmen, with the majority somewhere between the two. On the one hand we have a man who will never become a leader because he cannot back his own opinion, and must "pass the buck" to his foreman. On the other hand we have the man typified in the second character. This chap will usually be found to be a good workman who has had the misfortune to have worked under foremen of the "do as you are told" and "mind your own business" type, who have knocked all of the interest and desire to help out of him. The foreman should educate this kind of man back to a better frame of mind, and he will probably have the better man in him and a better producer than in the other type.
—HARRY CLARKE, *England.*

Cutting Down Unnecessary Repair Costs

GROUP bonuses are a good means of cutting down unnecessary repairs but it is better to provide an efficiency bonus or a savings bonus instead of penalizing the group bonus provided. Firing a man is likely to invite trouble with the ever-present trouble-making element in every department and will merely create unrest among the remaining workers.

Before announcing a group bonus for increased machine efficiency post notices stating just what breakdowns have cost the shop directly and indirectly and what this drain would probably amount to in the next six months unless more care is taken. By means of posters show the men where to put wrenches and tools to avoid what has happened in the case of some accident to a machine. Provide shelves on the machines, within easy reach of the operator. —J. C. P. BODE.

More About Discipline in the Shop

THIS method of discipline is workable enough, but I feel that in too many instances it is worked overtime, and has the dangerous aspect of using kindergarten methods of discipline on men that are now living in a very self-conscious age. In stepping up Sam Brown to the detriment of Bill Jones, Bill becomes a soured proposition, wounded in pride and shop standing, and feels that Sam must have been playing for his job on the sly. This method of discipline engenders discord, suspicion, and general contempt.
—J. A. HOPE, *Asst. Shops Eng., Canada.*

OUR friend Al, to my way of thinking, has been a level-headed fellow with the earmarks of a good foreman, but, his successful career has been dealt a hard blow. If Bill Jones has been "left go" to the extent that he is "cocky," and turns out work that looks like a rank amateur's, then Al has been lax in his duty as a leader, and has now gone back to the primitive

method of humiliation. The result of his so-called discipline will be that Al will be looking for a good helper, the old one now having Bill Jones' job.

—H. D. BOCK.

AL HAS the right idea in disciplining a man with the high and mighty attitude. Changing a man from a job to an inferior one and assigning someone to take his old job, shows him that he isn't the only frog in the puddle. It isn't the man that has been on the job for a long time that is so apt to show this attitude, but the youngster who has just graduated from the apprentice class. Perhaps if he takes some time off he would be surprised to come back and see that the company is still running, and that there is someone who can do his job. —BENJ. C. THOMAS.

Getting to the Big Boss

GETTING to the big boss, or at least getting one's problems to him, is not difficult in an organization which sanctions employee representation on the management in the settlement of questions that involve labor.

In one company an Industrial Relationship Committee has full and final authority in all disputes between employees and other employees or their foremen or the management. This committee is composed of twelve men from various departments of the shop who are elected by their co-workers and continue with their regular work except during meetings which are held on company time and at the company's expense.

The functions of the committee are manifold, but among them are matters of classification of work, establishment of base rates, distribution of short time in dull periods, settlement of personal causes of discontent, and renewal of cases where the foreman's right to employ or discharge is questioned. Any complaint can be carried to the committee without fear of retribution, although it is obvious that an unjust or chronic complainant will soon lose caste with the committee and with his fellow-workers. —WM. C. LANDIS.

Who Should Select New Equipment?

WHEN the fact is considered that machinery salesmen do not interview shop employees when they make a visit to sell their product the fallacy of Williams' stand can be realized. The engineering or planning departments, by virtue of their direct connection with the production end of the shop, should have the final say when new equipment is to be ordered. Just imagine what would happen if Charlie was to quit and the man who took his place was "sold" on the Sullivan. Would Williams accept that as an alibi for poor production? However, the workman may suggest to his foreman the value of certain machines, and the foreman in turn may bring up his suggestions, but to have the final say—never! —SAMUEL KAUFFMAN.

Cutting Down Spoiled Work

WHERE the inspectors are doing inspecting from all departments, we will find little grudge and prejudice, since many rejections would result in an inspection of the inspection department itself. If the work passes the gages used by Ed and is still rejected, it shows that Ed's gages are inaccurate.

But supposing that the gages are correct, was the spoiled work due to a worn machine, poor tools, wrong speeds and feeds, or inexperienced operators? In the average shop the responsibility rests on the foreman. After a job is set up and a few samples are run through, he should check them himself, or have the inspection department do so, thus providing also a check on his gages.

Exhibiting a man's spoiled work to others in the shop would mean that he would be forced to leave the employ of the company due to being held in contempt by the other employees, and also because of having his own personal pride hurt by this exhibition. But if we place on exhibit the good work done by the men we can rest assured that it will provide a stimulus towards better workmanship. —ALEXANDER I. NEWMAN.

SPOILED work cannot be eliminated from a shop by inspection alone, or by the abuse of workmen. The safest and quickest way is to create pride in workmanship and co-operation between men and between departments. The display of monetary value of finished pieces, whether they pass inspection or not, will be of interest, but if a man has no pride in what he has made the cash value of the product will not concern him so long as it does not affect his pay check.

—F. F. ANDERSON.

THE man who hunts up the foreman to inform him of irregularities which occur in his work not only shows that he has an interest in his work, but also shows an amount of initiative intelligence which is of great value to his employer. More men of this type employed in the works would reduce the size of the scrap heap, and at the same time raise the standard of the product. —M. HAYGARTH, *England.*

The Practical Joker

THE worst about most practical jokers in the shop is that they generally get very angry themselves if they get a dose of their own medicine. Furthermore, they not only annoy the man they are playing with, waste his and their own time, but every one within sight is apt to stop and watch results. Altogether these fellows are entirely too expensive to have around the place. —J. C. P. BODE.

THE foreman should allow his men as much freedom in conversation as the nature of the work permits, which means that there will be little by the men working on accurate work. In most cases these men resent being interrupted or disturbed, but on repetition or monotonous work it is an advantage to have a little friendly conversation and "jollying."

However, "practical jokes" must never be permitted, at any time, in any place, under any circumstances, simply because every such joke leads to another one somewhat more serious than the preceding. The wind-up is always spoiled work, damaged equipment, a fight, or an accident, sometimes several "results" from one cause. —H. J. GUSTAV KOPSCH.

Ideas from Practical Men

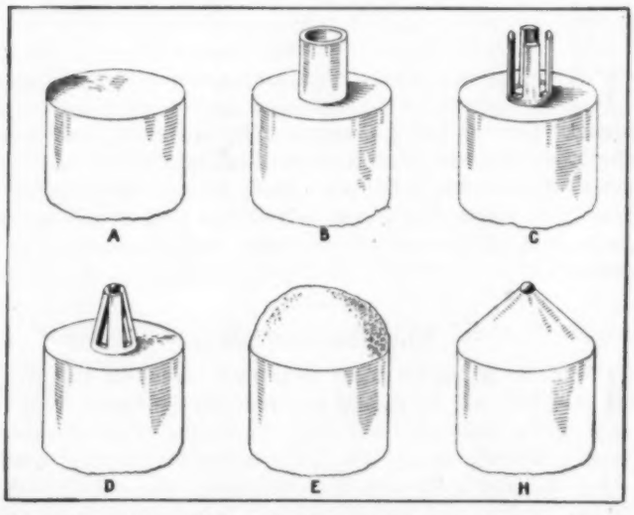
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

The Use of Diamonds on Gaging Points

BY H. A. SEABRIGHT

The use of diamonds in gaging equipment has become more general in late years. Especially is this true where heavy and repeated usage is encountered on precision work. The reduced frequency of calibrating and adjusting is quite an item whenever the gaging operations are extensive. In many cases the degree of accuracy is maintained more uniformly with diamond points than with points of steel, and they are thus more dependable in the hands of the workman of average ability.

The equipment to which diamond points are adaptable is quite varied and includes the various forms of micrometers, limit gages, indicators, size gages, and gaging machines.



Steps in setting diamonds for gaging points. A, blank point. B, drill hole and turn down end. C, slot and form fingers. D, insert diamond and close fingers. E, braze setting. H, grind off extra metal and polish diamond face

There is nothing complicated about the mounting or arrangement of the diamonds, so that practically all gaging equipment is more or less adaptable.

The size and shapes of the diamonds used depend upon the gaging equipment and the articles being gaged. In many cases diamonds weighing one-tenth of a karat are suitable, while those weighing one-half of a karat are needed only on the larger work. In most cases the diamond points are dressed to a smooth, slightly-curved surface. While diamond setting is quite important, there is nothing about it so difficult that an average good mechanic cannot do if reasonable care and judgment is used. Like most other things, there are a number of satisfactory methods in use and some prefer one, while others prefer another. In general, the main thing to be accomplished is a firm grip that will resist rubbing action from all directions. This is best accomplished by placing the larger end of the diamond in the setting and closing in around the smaller end, leaving a comparatively small point or surface of the diamond exposed. It sometimes pays to form the diamond so that one end is larger than the other, in order that a better grip may be obtained. The diamond should also approximate the shape of the bottom of the hole so that it will have a good bearing.

On smaller diamonds, the setting usually consists of drilling a hole of such size and depth that the diamond can just be inserted, closing in the metal by peening and then polishing the face of the diamond. The larger diamonds are usually set by reducing the diameter of the end of the gaging point and drilling a hole so that a thin circular wall of metal remains. This wall of metal is slotted so that four or more fingers project. They are closed in after the diamond has been inserted. The diamond is then brazed in place. In brazing, care should be taken to completely surround the diamond with metal, leaving a very small point only of the diamond exposed. The superfluous metal is removed by grinding on an abrasive wheel after which the diamond face is dressed and polished. In some cases the diamond is bedded in copper surrounded by steel. The illustration shows the steps.

USING DIAMOND DUST

While a reasonable amount of care is required in properly dressing the diamond point, or face, no particular trouble should be experienced in this operation. The usual practice consists of smoothing the surface, using a small copper wheel, in the face of which diamond dust is imbedded. The diamond dust used in preparing the copper wheel can either be purchased as such, or it can be prepared by grinding a few diamond chips in a small mortar with a pestle. The smoothness of the diamond surface can be determined by rubbing it on some object similar to the product being gaged. If there is no tendency to scratch or score, the polishing process may be considered finished. In most cases, the exposed face is about $\frac{1}{32}$ in. in diameter and is slightly convex. No sharp edges or points should project or come into contact with the gaged product.

Considered on a cost basis, the first cost of gaging points equipped with diamonds is somewhat higher than with plain steel points. This additional expense is more than compensated for in the long life and maintained accuracy of the diamond points. The comparative costs of a given gaging point for these two cases are as follows:

Plain steel gaging point,	
High-carbon steel gaging point, material only...	$ .50
Machining	1.00
Hardening	.25
Grinding	1.00
Total	$2.75
Diamond gaging point,	
Machine steel gaging point, material only	$ .25
Machining	.75
¼ karat diamond	3.50
Setting diamond	.25
Total	$4.75

The comparative life of plain steel points and diamond points, as found by repeated tests, shows that diamond points usually last at least ten times as long as the steel points, while in some cases, they last indefinitely. The life of the diamond point depends upon the treatment received in regular use and the security of setting.

If the pieces to be gaged are heavy and are bumped repeatedly against the diamond point, loosening of the diamond will occur. In some cases, the diamond will even be chipped or cracked if too roughly handled. While such abuse shortens the useful life of the diamond points, it is usually possible to provide means of protecting them from repeated blows of the pieces being gaged.

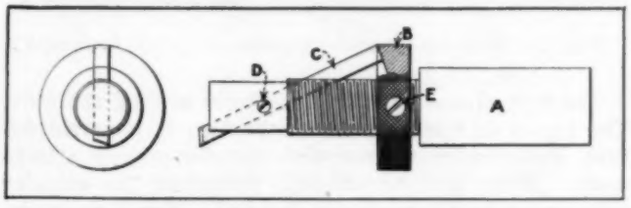
The greatest advantage of diamond points, when properly utilized, is their ability to maintain accurate adjustment. When we consider the time required to keep steel points in proper condition and adjustment, as compared with diamond points, there is little excuse for adhering to the steel points. In many cases, it is possible to operate with diamond points for weeks at a time without adjustment, while similar steel points have to be adjusted hourly. The degree of accuracy of the gaged product is likewise similarly improved.

An Adjustable Boring Tool

BY H. C. LINCOLN

The sketch shows a boring tool with fine adjustment for the cutting lip, to be used a turret lathe.

The large part is machined to fit the hole in the turret, the middle portion is threaded to fit the knurled adjusting collar *B*, and the small end is turned to a diameter that will allow the nut to slip over it. A hole is broached through the bar at an angle of about 60 deg., to take the square-sectioned tool bit *C*, the rear end of which bears against the concaved face of the collar *B*, while the headless setscrew *D* binds it in position after it has been adjusted. A similar setscrew prevents accidental displacement of the collar.



Boring tool with fine adjustment

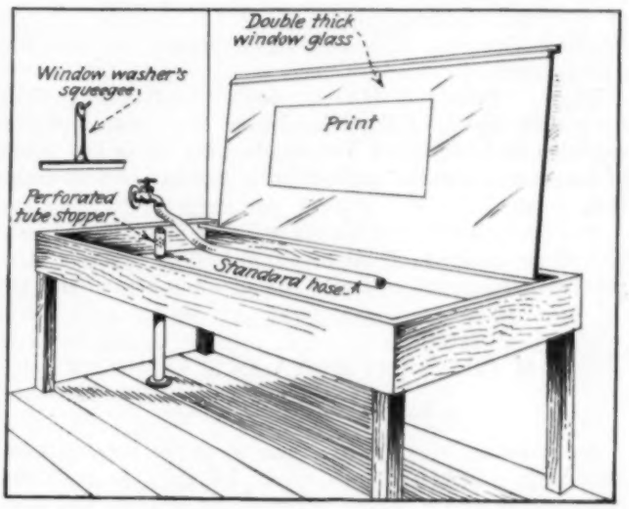
The fine-pitched thread of the collar, in connection with the angular disposition of the cutting tool, permits the most minute adjustments to be made in the matter of diameters of holes to be bored, and the collar functions further to prevent the tool from working backward under pressure of the cut.

Blueprint Washing Tank

BY LEWIS SKEEL

Where blueprinting is done in the old fashioned way, and a tank for washing the exposed prints is a necessary part of the equipment, the arrangement shown in the illustration will be found unusually convenient.

Placed in a corner of the drafting room or blueprint department, it requires a minimum amount of space.



Tank for washing blueprints

The tank is of the usual construction, with the cold water tap and the drain opening at one end. The regular rubber or metal drain stopper is replaced by a well fitted piece of tubing five or six inches long. A number of holes are drilled in the tube, beginning at a point where the water level is to be maintained. The holes should be of a size that will prevent any solid matter large enough to clog the drain from entering. The tube should be fitted so that it may be removed, in order that the sediment which collects in the bottom of the tank may be drained off. The squeegee is a very handy tool for scraping the bottom of the tank when cleaning it.

A length of rubber hose is fastened to the spigot to carry the water to the back of the tank. This makes a good circulating system, without violently agitating the water, and avoids splashing entirely.

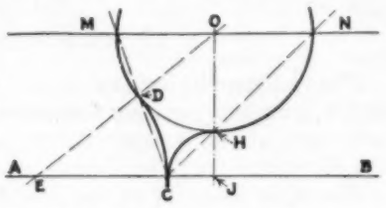
When the prints have been washed thoroughly, the surplus water may be quickly and easily removed from them by placing them on the vertical glass, and going over them with the squeegee. When the prints are large and must be folded, it is best to have the fold at the top, and squeeze the water toward the open ends. This method is much easier than the use of blotters and eliminates the need of extra table room for their use. That it is far superior to a print wringer, particularly for small prints, is quite obvious.

A Problem in Drafting—Discussion

By Paul Lyth

The drafting problem presented by M. A. Durland on page 221, Vol. 66, of the *American Machinist*, has another and, I believe, simpler solution that gives two possible answers.

The problem, as stated by Mr. Durland, is to locate on the line *AB* the center of an arc that will be tangent to the given arc *MN* and pass through the point *C*. Draw through *O* a line parallel to *AB* (horizontal in this case). From point *M*, the intersection of this line with the given arc, draw *MC*, and from *O* draw a line through *D*, the point of intersection of *MC* with the arc, meeting the line *AB* at *E*, the center of the reducing arc.



The two possible solutions

Proof: Triangle *MDO* is similar to triangle *CDE*. Line *OM* equals line *OD;* hence the triangles are isosceles and therefore *EC* equals *ED*. *D* is the point of tangency since the radii of both arcs are in a straight line.

The construction for the second case is similar. Draw *NC*, thus locating *H;* then draw *OH* to locate *J*, the center of the required arc. The proof is also similar.

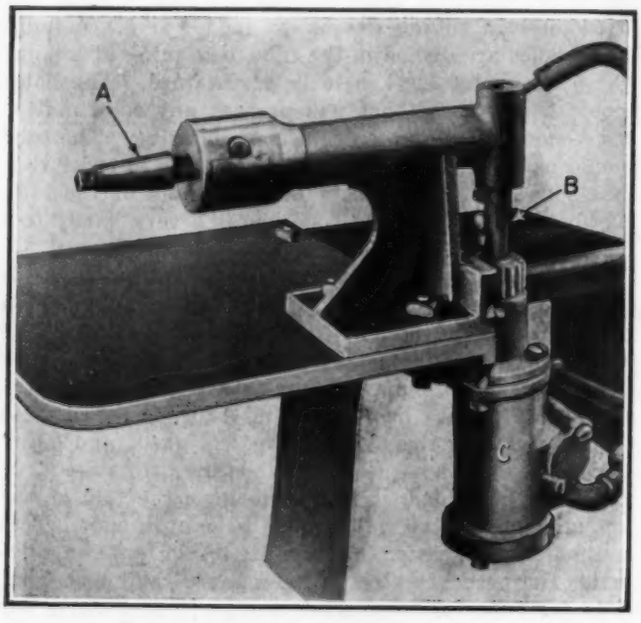
An Air-Operated Cock Grinder

By Matthew Harris

In grinding a cock, the plug is never rotated continuously, otherwise rings would be worn in both the body and the plug, which rings would prevent the plug from being properly seated, thus defeating the purpose of making a tight joint.

The air-operated cock grinder shown in the illustration is in use in the pipe department of the Lackawanna shops at Scranton, Pa. The plug is held in a chuck on the end of the spindle, as at *A*. A pinion on the rear end of the spindle meshes with a rack on the upper end of the piston rod *B*. The rod is connected to a piston working within the cylinder *C*. Air is admitted to opposite ends of the cylinder, alternately, by a kick valve such as operates the compressor of the air-brake system of railroad trains, causing the rod to reciprocate.

By the means described the spindle is given about one and one-quarter turns in each direction, this action being continuous. The cock body is engaged with the plug, being held in the operator's hands, and is removed every now and then while fresh abrasive is applied.



A simple cock grinder

Milling Housings for Victaulic Pipe-Joints

By George Collins

Housings for victaulic pipe-joints must be accurately made and at the same time they must be produced at a moderate cost. In order to reduce the cost we are milling them by the methods shown in the illustrations.

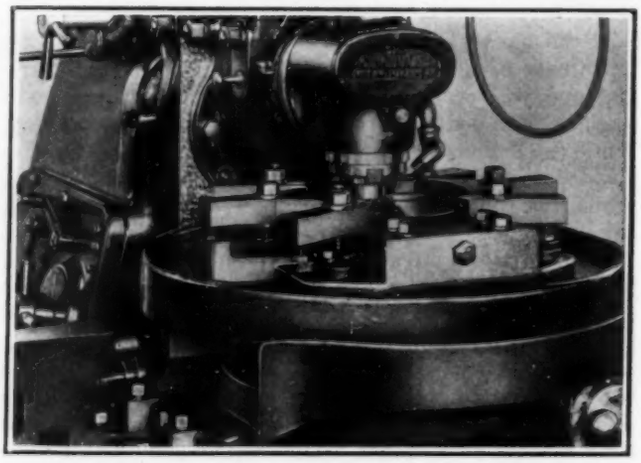


Fig. 1—Machining the bores of joint housings

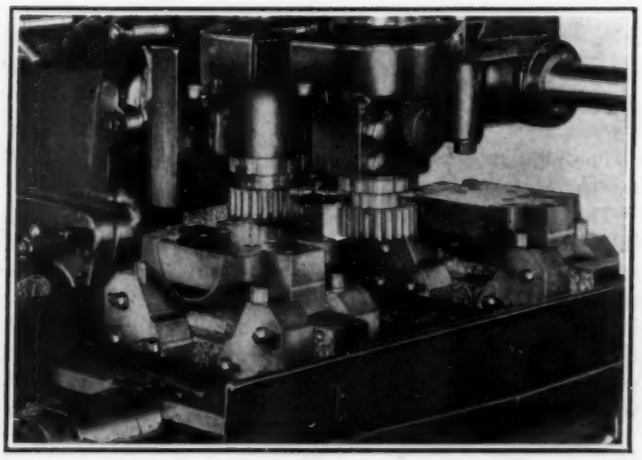


Fig. 2—Machining parting faces of joint housings

The first operation, Fig. 1, is form milling the bore. The halves of the housing are held in a universal fixture, mounted on a power-fed, circular-milling attachment. After making one-half revolution the circular attachment is automatically stopped. The slide carrying the fixture is then adjusted to centralize the other

half of the housing. While this piece is being milled, the completed half is removed and another piece is loaded in the other half of the fixture. Thus, with the exception of centralizing each piece, the milling is continuous. A form cutter mounted on a stub arbor runs at 87 r.p.m. The production is 52 pieces per hour.

After the bore has been milled, the parting face is machined, using a two-spindle vertical attachment and the reciprocating method, as shown in Fig. 2. Fixtures are mounted at each end of the table and two pieces are held in each fixture by quick-acting clamps. Plungers are brought up under the bolt seats, forcing each piece against a hardened block that fits the bore. Two 4-in. Stellite, shell end-mills are used, running at 154 r.p.m. The feed is 25 in. per min. and the production is 274 pieces per hr. The material is malleable iron.

Alterations to a Radial Drill

By P. H. Wilmarth

Having to machine the wheel heads for a new series of grinders, we found that our largest radial drill was not high enough, nor was the base large enough to handle the work in the manner in which we had decided it should be done. Since the maker of the drill was unable to furnish us with parts such as were wanted, we proceeded to make the alterations ourselves.

The details of the new base are shown in Fig. 1. It is 7 ft. square and 8 in. thick and has T-slots at right angles on 12 in. centers. An extension was provided to take the gearbox unit, and a 9 in. filler piece was put under both the column and the gearbox to increase the vertical range. For leveling the base, provision was made for four 1¼-in. screws where the T-slots intersected at *D*, steel disks having been set in concrete under these points, and on which the points of the leveling screws were to bear. After the base had been set and carefully leveled, it was tested for flatness by a 4-ft. straight-edge placed around the sides and across both diagonals.

Additional precautions were taken to get good bearings on shims placed under the eight lugs around the outside. Upon the completion of the tests, four lock-screws were set down tightly on the heads of the leveling screws to prevent the latter from getting out of adjustment. A sand dam was then put all around the base and cement grout was poured to fill the space.

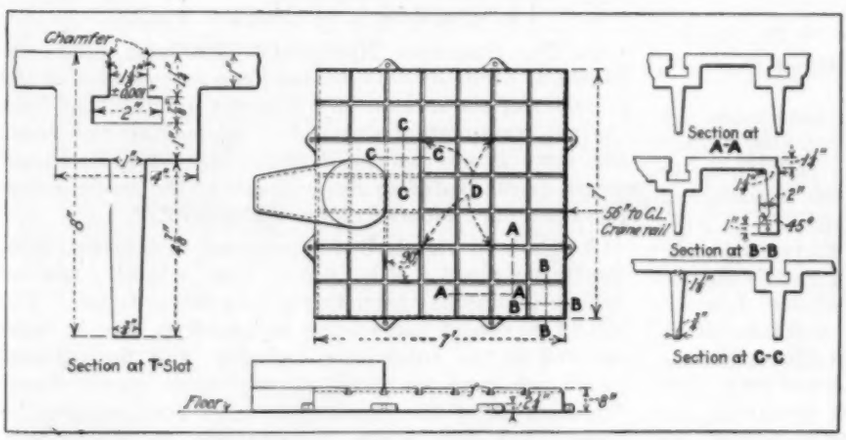


Fig. 1—Details of the new base

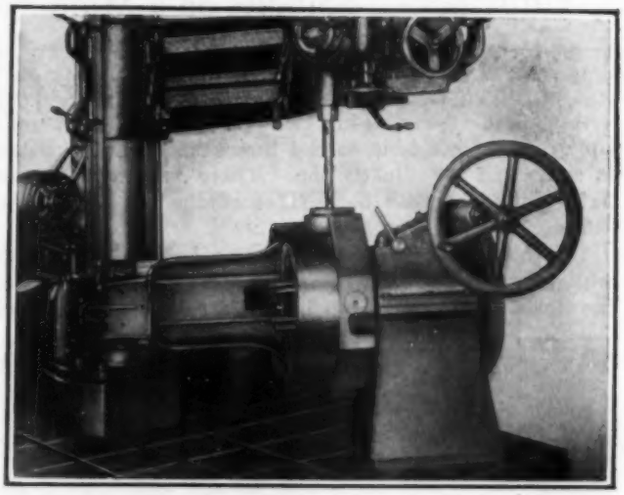


Fig. 2—The machine after assembly on the new base

After complete re-assembly as in Fig. 2, the maximum variation shown by a dial indicator clamped to the spindle was 0.003 in. at any part of the base.

The jig shown in the machine in Fig. 2 is holding the work for which the alterations were made. Both the jig and the casting to be drilled are attached to the faceplate of an indexing fixture. A small jig is shown at the left-hand end of the work.

One revolution of the fixture makes every hole accessible, and the worm gear at the right makes the operation of indexing easy, although the casting has 200 lb. of overhung weight, about 13 in. off center.

Zinc Plating of Steel Springs

By A. L. Walker
Kennington, England

Zinc has always been a favorite metal for the plating of iron and steel articles. One disadvantage, however, is that the action is such as to render brittle all spring steel so treated. Various theories have been put forward to account for the action, but the fact remains that a spring perfectly good before plating becomes brittle to the point of breaking as soon as a force is applied to it after a few minutes in the bath.

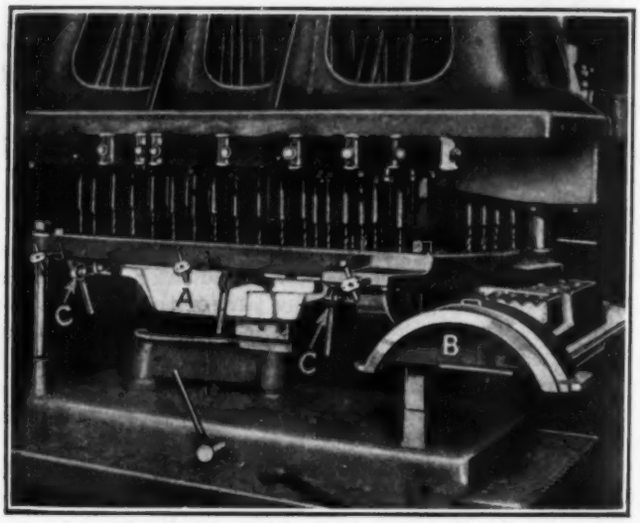
There are some manufacturers who have abandoned the process of plating their springs for the reasons given above. Blued steel is not nearly so resistant to corrosion as steel that has been given a good plating of zinc. I made a number of experiments to find if there was a way of removing the trouble. Tests showed that the brittleness produced was somewhat proportional to the rapidity attending the plating operation. The best way out of the difficulty seemed to be to give the springs some heat-treatment after plating. After numerous experiments we found that immersion in boiling water for half an hour removed the greater part of the brittleness. Instead of water, oil may be used. Oil has the advantage that no danger of rusting is incurred, and an oil bath improves a plated surface.

Utilizing All Spindles on a Multi-Spindle Machine

By R. E. Marks

A method of combining two operations under a multiple drilling machine at the Franklin automobile shop is shown in the illustration. There is a combination fixture that handles both sides of the oil pan at one setting.

The bolt holes in the flange are being drilled at *A* while at *B* a pan so drilled has been turned over and the holes for the oilpump body bolts are being drilled.



Double drilling on a multiple machine

Cam-control clamps as at *C* are used in the first position. By combining the operations, all the spindles are utilized and two operations are performed at one setting.

A Method of Checking Threads—Discussion

By Arthur Silvester

Referring to the article under the title given above, by Charles Kugler, and published on page 877, Vol. 65, of the *American Machinist*, I fail to see that anything is gained by the method described. Mr. Kugler says: "In case the wire *D* is loose, either the pitch is too great, or, in the case of U.S.S. threads they may have been cut too deep. If the wire projects above the tops of the threads, the opposite is the case."

Assuming that the circumstances are as Mr. Kugler states them, how does he calculate the amount of error, if any, at the pitch diameter?

Wires for measuring taps, gages or chasers are not entirely satisfactory, for the reason that the contact is always uncertain on account of the small bearing surface. Wires will crowd down into the threads and the article being so measured will be smaller in pitch diameter than if measured by a thread micrometer.

If I had a chaser to check and there was no master thread gage or measuring machine available, I would turn and rough thread a piece of stock and then finish it with the chaser. If care is taken in finishing, the chaser will take light, scraping cuts and will be in contact on all parts of the threads, thus producing its counterpart. Whether or not the chaser is correct, can be found by checking by a thread micrometer.

Practical Shop Problems

Questions of a Practical Nature will be answered in this column

Dimensions on Bevel Gears

Q. In the American Machinists' Handbook, *page 194, the dimension for the backing on a bevel gear is given from the end of the gear to the sharp corner of the tooth. All of the catalogs which I have, except one, show this dimension to the pitch line of the tooth. Which dimension is correct for drawings?*

A. We believe that the method used in the handbook is the most practical way of showing the dimension on a working drawing going into the shop. The dimension to the sharp corner of the tooth is the only one that can be used by the mechanic in turning up the blank, and if this is not given he must calculate it himself.

On the other hand it is easily understood why a catalog dimension, or a dimension on a specification, should be given to the pitch line, since such a designation is an indication that the meshing centers are to be accurate. For the same reason it is a good plan for the draftsman to put both dimensions on the drawing, so that the workman will have no calculations to make in the shop.

Tackling the Spoiled Work Problem

Q. We are a medium sized concern manufacturing machine tools, and at present our chief trouble is scrapped work. Just how to eliminate this waste of time and material is a vital question with us, and we would like an expression as to the remedy for it.

A. It is difficult to give more than a general statement without detailed information on the problem. As long as the human factor enters into operations there will always be spoiled work, the amount of which is directly dependent upon many factors, such as quality required, equipment used, frequency of set-up changes, fatigue involved, etc. In fact, we believe that almost every shop presents a special case in itself in this respect. To make any recommendations it would be necessary to have complete details of the nature of the spoiled work, and how far preventive measures have already been carried.

Heights of Cap Screw Heads

Q. The American Machinists' Handbook *gives the height of heads of hexagon-head cap screws as ¾ of the diameter of the screws. We have not yet departed from the old manufacturers' standard of making the heads the same height as the diameter of the screws, and would be interested to know if any of the screw manufacturers have adopted this new standard.*

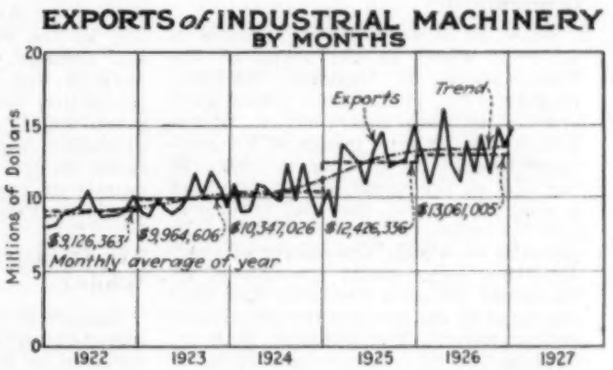
A. The new standard was proposed in October, 1925, jointly by the A.S.M.E., S.A.E., and A.E.S.C., and we believe that it has been fairly generally adopted. The S.A.E. handbook shows the standard as having been adopted in the automotive industry, and the catalogs which we have on hand of two large screw manufacturers show the standard to have been adopted by them. The ¾-in. screw, for example, is offered with head ⅝ in. in height, which corresponds to the formula.

Activity in the Metal Working Industries

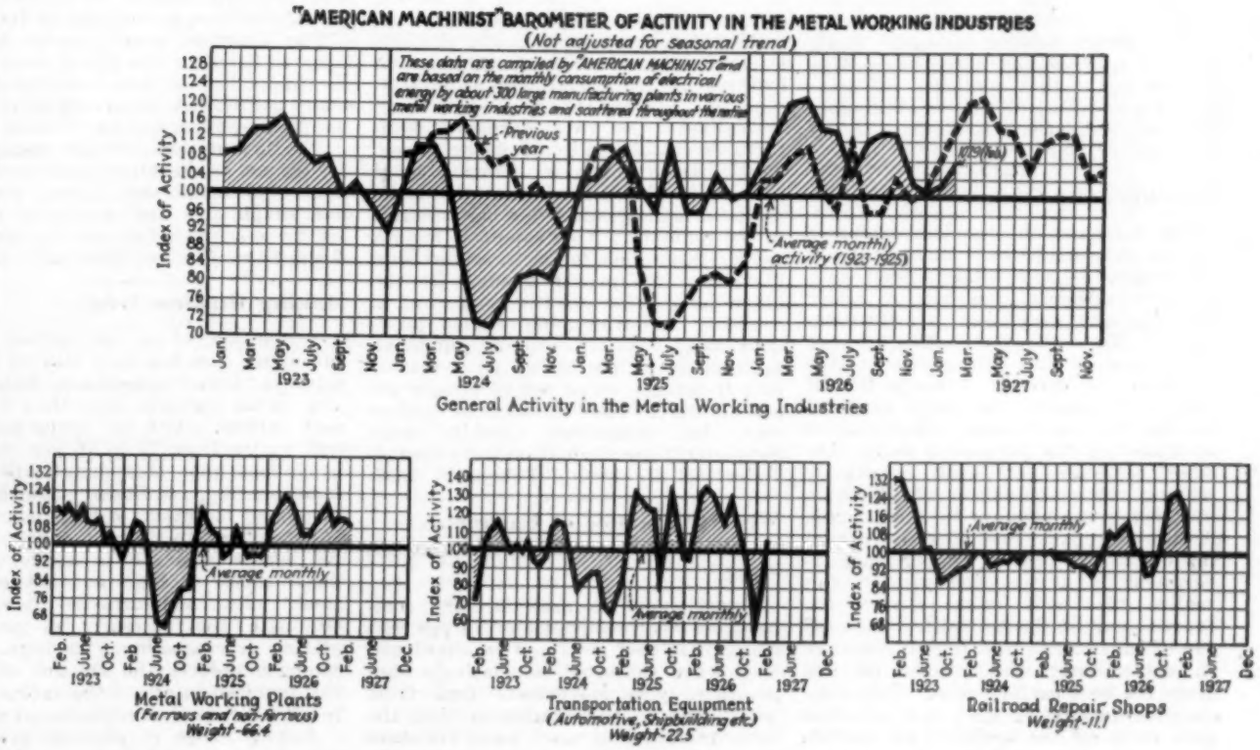
Productive Operations Lower Than Last Year

That productive operations in the metal working plants during the first quarter of the present year are continuing high is indicated by reports on electrical energy consumption in these plants during January and February. These energy consumption reports, however, indicate that the productive operations during the first two months of this year are on a plane about 3 per cent below that reported during the same period of 1926. This situation in the metal working industries is general in American industry taken as a whole, and is in agreement with the general opinion that industrial production during 1927 will be from 5 to 10 per cent below that of last year.

The outstanding factor in the metal working industries during January and February was in a materially increased activity in the automobile plants of the country. Operations in the automobile plants reached an unusually low point during December, the lowest monthly production recorded since 1921. The January automobile production, however, was 44 per cent higher than that of December, and February production was 43 per cent higher than that of January, so that the activity in the automobile plants during February was approximately double that of the month of December.



These conclusions, and the charts on industrial activity, are based upon electrical energy consumption data as collected by the *Electrical World*. Exports of industrial machinery during January, according to Department of Commerce figures, amounted to $14,946,842, which figure exceeded the export total of any month, with a single exception, since 1921. Economic conditions at the opening of March indicate a continued stability in business and industrial operations, which should be reflected in a continued high activity in the metal working industries.


"AMERICAN MACHINIST" BAROMETER OF ACTIVITY IN THE METAL WORKING INDUSTRIES
(Not adjusted for seasonal trend)
These data are compiled by "AMERICAN MACHINIST" and are based on the monthly consumption of electrical energy by about 300 large manufacturing plants in various metal working industries and scattered throughout the nation
Index of Activity
Previous year
Average monthly activity (1923-1925)
1923
1924
1925
1926
1927
General Activity in the Metal Working Industries
Average monthly
Metal Working Plants
(Ferrous and non-ferrous)
Weight-66.4
Transportation Equipment
(Automotive, Shipbuilding etc.)
Weight-22.5
Railroad Repair Shops
Weight-11.1

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Technical Abstracts

Wheels Removed and Pressed on Economically

When it is necessary to remove a worn-out wheel at the shops of the Wilkes-Barre & Hazleton Railway, Hazleton, Pa., it has been found good practice to burn the wheel to within ¼ in. of the axle by means of an acetylene torch. By driving a wedge in the slot at the tread, or by applying a slight pressure, the seal is broken and the wheel is removed easily. In pressing on wheels, the danger of shaft distortion, so generally encountered by the usual pressing methods, has been overcome by the use of a thrust cylinder and mandrel. The cylinder is made of steel, 13½ in. in length and 9½ in. in diameter, bored to fit snugly over the wheel fit, with the end pressing against the wheel seat. The mandrel is made of steel 24 in. in length; 6 in. in diameter at the small end, and 7 in. in diameter at the larger end. A ½x6-in. projection extends from the large end, fitting the bore of the cylinder. This projection does not touch the axle.

To press on a wheel, the thrust cylinder is placed on the wheel fit with its face pressing against the wheel seat. The mandrel next is put on with the projection entered into the cylinder bore and the other end against the press ram. With this equipment, the entire pressure is exerted against the wheel seat, thus eliminating the danger of shaft distortion due to shaft end pressure. A press of 400 tons capacity with a 25-ton release is used. Each wheel is lettered and dated when it is pressed on so that complete information of any wheel or axle is obtainable when desired.—*Electric Railway Journal*, Feb. 19, 1927.

Passenger-Car Costs

One company that makes extensive use of salesmen's cars finds it more economical to use small, cheap cars for city salesmen and bigger, better ones for men who have to make long jumps. The cost of operating the car is charged to the selling expense account of the driver. Average life of cars is 30 months for large cars, 24 months for small ones. Depreciation is figured at 33⅓ per cent a year. Another company gets good results by seeking the co-operation of salesmen in keeping car expense to a minimum. A third company finds that by charging off 25 per cent of the original investment in a car each year it can realize the book value during the fourth year of the car's life. Records are of importance to a fourth company in determining which make of tire gives the best performance. This company depreciates its cars at a rate that gets them off the books in 24 months. A monthly depreciation of $15 per car enabled a fifth company to get the book value as a trade-in allowance. Eighteen months was found to be the economic life of the car. Operating costs of $85 a month in the country and $50 in the city were found to be a fair average. There is a general tendency to look on the automobile as a production tool, to be replaced after a given length of time. As long as its operation cost is within reasonable limits no great stress is laid on minute details of expense.—*The Magazine of Business*, February, 1927.

Are Industrial Shows Worth While?

Industrial shows are becoming numerous, and are coming in for close scrutiny on the part of manufacturers from the standpoint of costs and results. The relatively small number of shows at which it is possible for a manufacturer to exhibit makes it necessary to exercise discrimination.

The cost of making an exhibit that will attract attention at a big industrial show is usually substantial. The cost of the space is only one of several items. In addition are the salaries and expenses of a number of salesmen, the cost of moving and installing the exhibit material, the cost of entertaining, which often runs high, and the general wear and tear on the sales organization.

A number of different manufacturers of machinery lines were interviewed with the idea of getting their reactions to the value of exhibiting at shows, and varied opinions were expressed. A maker of roller bearings, who exhibits at eight shows annually, charges up the expense to the advertising appropriation, but has made direct sales from the exhibits. An air compressor manufacturer exhibits at 6 to 8 shows a year, and believes that when common sense is used in the expenditures the right choice of a show can give a big stimulus to the industry. This company finds a show a good place to get its advertising literature into proper hands. On the other hand, the sales manager of a company manufacturing welded products stated that his company put in an appearance at the shows as a matter of self-defence so as not to appear too conservative. The consensus of opinion was that industrial exhibits were beneficial if discrimination were used.—*Industrial Marketing*, February, 1927.

Wear Resistance of Carburized Steel versus Cast High Manganese Steel

Experiments to ascertain the comparative wear resistance of 14 per cent manganese cast steel and casehardened steel when subjected to relatively high pressure with movements free from shock lead to the conclusion that the latter material is much more resistant to wear in this type of service than the former. This is true for low carbon steels as well as for carburized medium carbon steels and applies to 14 per cent manganese steel castings in their various structural modifications depending upon thermal treatments.

The favorable results from casehardened steels obviously depend on the care exercised in the carburizing and heat-treatment of the steel.

Plastic flow under heavy pressure during a gliding motion is apparently the cause of abrasion on manganese steel while it has decidedly less influence upon casehardened steels—W. J. Merton, in *Transactions of American Society for Steel Treating*, February, 1927.

The Importance of the Layout Man

The value of the layout man in the present day machine shop is not always fully appreciated. The layout man must be an expert machinist with a good knowledge of machine shop mathematics. He must have a thorough understanding of the operation of all the machines in his department, since many castings and forgings can be laid out from either of two sides, but can be clamped to the table of the machine in only one way. In the case of simple jobs, where jig or templet is used to hold the work and guide the tool, the layout man must check the jig or templet for accuracy. An error might ruin hundreds of pieces. The layout man is called upon to lay out all work for which there are no jigs or templets.

The foreman should never be too busy to listen to the layout man when he thinks he has found a mistake, as many arguments, occurring after work has been spoiled, can be avoided.

The layout man, if not engaged in laying out or checking, should have the ability to make sheet metal templets and simple jigs and should be able to set up machines for any operation.—*Open Shop Review*, February, 1927.

Making Rustless Iron

Production of a low-carbon, high-chromium iron has been started by the Rustless Iron Corporation, Baltimore. The metal contains less than 0.1 per cent carbon, while the chromium content varies from 11 to 16 per cent. It is claimed that this metal will resist atmospheric conditions indefinitely, takes and maintains a high polish, and is not subject to stain by organic acids. Its tensile strength is approximately three times as high as that of mild steel. Its non-corrosive properties eliminate the necessity of painting, plating or enameling. Its high tensile strength reduces the amount of material required to attain the safety factor in all fabricated constructional work.

A wide range of physical properties may be obtained by oil quenching this metal from 950 deg. C. and subsequently tempering it at increasing temperatures

up to 800 deg. C., or annealing it at 900 deg. C.

Ferrosilicon and chrome ore are added to the initial bath of molten metal for conferring rust-resisting properties. Lime and other fluxes are added to facilitate the reduction process. The metal is cast in ingot molds. After cooling, the ingots are surface skinned on a planer, so that surface defects that may be present are eradicated at the earliest possible stage. The ingots are reheated and rolled into blooms, billets, bars, slabs and steel bars.

While the heat for the initial melt is generated by electric current, reheating the ingots for rolling is done in coal-fired furnaces of the continuous type—D. St. Pierre du Bose, *Iron Trade Review*, Feb. 17, 1927.

Selecting and Using Babbitts

There is no economy in using a high grade babbitt where a low grade alloy will suffice. A cheap babbitt metal may give almost indefinite service under a condition of light load and no impact, but would quickly fail if installed in a bearing subject to high pressures and speeds.

A good bearing metal must have plasticity to enable it to adjust itself to imperfections. This property is obtained by scientific alloying in the best grades of babbitt. The maximum pressures allowed on main shaft bearings in steam and gasoline engines is from 350 to 700 lb. per sq.in., depending upon speed, nature of lubrication, and operating temperature.

For high speed machines only light loads can be used on the bearings. The allowable pressure for motors is sometimes as low as 40 lb. per sq.in. With too great a load at high speed the babbitt will soften with the increased temperature. All of the babbitt alloys have only about one half the compressive strengths at 212 deg. F. that they have at 70 deg. F., so that a bearing to run at high temperatures must have generous proportions.

For casting the bearings the babbitt should be melted quickly and cast at once. Prolonged heating is injurious to the alloy. Babbitts high in copper require a high pouring temperature, and stirring before casting. The mold should be heated and then cooled down to between 200 and 500 deg. F. before pouring the babbitt. Thin bearings require the hottest molds.—C. W. Hudson, *Mill Supplies*, February, 1927.

What is Co-operation?

Throughout the entire history of co-operative effort, personality has been a most important factor. Conditions change, and the ways in which characteristics show themselves alter, but the types remain. It is believed that compulsory co-operation is not necessary, nor even desirable.

Co-operation is the act of working together for the joint benefit of all. Failure to co-operate may masquerade under many disguises, and one who is not co-operating may resort to subtle evasions and modes of defense, but he is nevertheless hostile to progress. However, any plan of co-operation which takes away from management the responsibility for management is bound to be inefficient and fail.

Co-operation excludes all idea of aimless and rival endeavors, and implies the concept of order and combined effect. The more zealous and united the efforts, the more effective will be the results. Co-operation cannot exist without the idea of preparation and planning ahead of the work.

Effective co-operation contemplates consideration for the rights of others, but the crafty man who thinks to gain all of his ends by being all things to all men does not co-operate. To co-operate, a man should have opinions of his own, and when they are sound he should have no hesitancy in standing by them.

There is nothing cheaper than lip service. The man who is really co-operating is dependable in every way, ready to place the good of the whole above the good of the individual. Every large business that is successful has brought together interests, and has substituted co-operative effort, friendship, and good will for the petty jealousies and wasteful antagonisms of individual competition.—John J. Reynolds, *Aera*, March, 1927.

First Hudson Type Locomotive

The New York Central R.R. has just placed in service the first 4-6-4 type locomotive built in America, and has classified it as the "Hudson" type. The four-wheel trailer permits the development of a material increase in boiler capacity and in maximum horsepower output in a six-couple driving-wheel base, over that obtainable in locomotives of the Pacific type.

The total weight of the locomotive is 343,000 lb., of which 182,000 lb. is on the drivers, 63,500 lb. on the engine truck and 97,000 lb. on the trailer truck. The tender weighs 209,000 lb. The additional length of trailer truck made possible an increase in the size of the firebox and in the boiler capacity. The firebox has a grate area of 6,456 sq.ft. The feedwater heater is below the top of the smoke-box shell, and is supported on a shelf just back of the front-end door ring.

The trailer truck follows the principles of suspension and weight distribution of the Delta type two-wheel truck. The front wheels of the trailer truck are 36 in. in diameter and the rear wheels, which carry the booster, are 51 in. in diameter.

The location of the feedwater pump on the left side under smokebox, permits a free flow of water from the tank to the pump, and a short delivery from the pump to the heater. All steam valves have, as far as possible, been kept outside the cab under a housing over the boiler, and are operated by extension handles passing through the front wall of the cab, where they are arranged on an instrument board and clearly labeled. With the exception of the air and back-pressure gages, all of the gages in the cab have been placed on the instrument board. Among the special equipment are automatic train control, force feed lubricator, sanders, bell ringers, and an air operated whistle.—*Railway Age*, Feb. 19, 1927.

Use of Angular Contact Ball Bearings

A reduction of manufacturing costs can be obtained by using ball bearings that will carry combinations of thrust and radial loads.

The early type of ball bearings known as the cup and cone type, which were used in the bicycle, were of angular contact form.

In nearly all types of mechanism there may be two kinds of loads, a radial load acting at right angles to the shaft and a thrust load acting in a longitudinal direction relative to the shaft. These loads may be operating individually or in combination, but modern ball bearings of either angular or annular type can sustain combination loads within their capacity; in fact, a ball bearing of correct design has greater capacity under certain combined loads than when functioning under pure radial load. The reason for this is obvious.

Again in general, the stated carrying capacity of a bearing is its ability to withstand pure radial load, and, under combined loads, its capacity must be modified so that the allowable maximum load on the heaviest loaded ball under pure radial conditions is not exceeded by any load made up of thrust and radial combinations.

The fact that a ball bearing in operation has contact pressures in the neighborhood of 130,000 pounds per square inch absolutely prevents the formation of an oil film, and therefore, the bearing operates under metal-to-metal contact. This point, combined with the fact that in an angular contact bearing all the balls can be loaded, can advantageously be used in machine tools.—T . C. Delaval-Crow, *Machinery*, February, 1927.

How the Stroke-Bore Ratio Affects Engine Operation

Every time a new engine is designed, the best proportion of stroke to bore is one of the problems that confronts the automotive engineer. Power, thermal efficiency and smoothness are all subject to change with this ratio, as well as reliability and durability. Therefore, in making comparisons, two motors should be chosen having widely different stroke-bore ratios, while all features not dependent on this ratio should be the same. The most logical plan is to so proportion the parts that the stresses in the various members and the unit pressures on all bearing surfaces remain the same. Then the effects of the stroke-bore ratio on the operating efficiency may be considered. In this study two engines of equal displacement are considered, one having a stroke-bore ratio of 1:1 and the other a ratio of 2:1.

Points in favor of the short-stroke engine are: lower weight, less inertia forces, smaller unit loads due to inertia on bearings, higher corresponding critical speeds, larger valves can be used, it can be run at higher speeds with safety developing more power. The long-stroke motor may have some advantage in fuel economy, but hardly sufficient to be detected.—*Automotive Industries*, Feb. 26, 1927.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

What To Do with Spare Time

ONE of industry's greatest opportunties, and one of its most pressing duties as well, is to see that proper use is made of the free hours formerly spent in drudgery. When the "American Machinist" was cutting its first tooth the daily wage of a machinist in America was in the neighborhood of two dollars. In some of the European countries it was barely a quarter of that amount. Keeping body and soul together was no small task in those days. To make matters worse, the work week was from 54 to 68 hours.

Two things, at least, we owe to the machine. It has made the work easier and the work day shorter. If the time gained is to be wasted there is some doubt as to the value of the short day.

Here is where industry's opportunity lies. Obviously, it is impossible to force a man to improve himself during his free hours but it is not at all difficult to show him that it is very much to his advantage to make some good use of them. If he is of the type that can never rise above the monotony of machine tending or other repetitive work he should have some sort of an avocation that will round out his life and he should be encouraged to pursue it. If, on the other hand, he is ambitious and intelligent, his spare time, or some part of it, can very well be spent in fitting himself for promotion. In this case, industry will help itself by helping the man to develop his capabilities.

Industrializing the Farm

MUCH has been said of machinery and labor saving equipment on the farm. Possibly the feeling has become too prevalent that what has been accomplished in industrial plants to lighten the burden of physical work and increase production by automatic power appliances is also generally true of the farm. But, in what small proportion this has actually been accomplished, and what a tremendous field still lies open to development by the engineer and the machine builder to make the American farm capable of enjoying the benefits of this industrial age, are seen from a few figures.

According to statistics compiled by the National Electric Light Association, only about seven per cent of American farms have either gas or electric current. This means that fully 33,000,000 people in the United States still resort to primitive methods of lighting, and are deficient in the readiest modern source of power.

The average cost of bringing this power to every farm in the country has been estimated to be not over $750 per farm, or little more than the family pays for its piano, or less than for its automobile. When the engineer spreads out a network of electric power lines to our rural districts, a vast market for labor saving machinery will be opened to the manufacturer, while the farmer will gain in comfort as he gained during the last two decades by the network of roads that relieved the burden of his transportation.

Laziness vs. Alertness

THAT laziness is altogether an evil has been contradicted, philosophically speaking, by a statement made to the effect that men possessing a streak of laziness make good executives. This phenomenon is explained by the lazy man's likelihood to take short-cut methods whenever he can. Hence, a business executive, embodying laziness, can often figure out the easiest way to perform a task. Like other habits, however, laziness can be carried to an extreme so that it is wise to know just how much to incorporate.

The Cause of Present Prosperity

IN THE past, economists and other commentators on business conditions have been accustomed to placing great reliance on business cycles and on the situation in certain key industries. Iron and steel have been considered as unfailing indicators of economic trends. So has the building industry. And more recently the mighty automobile industry has claimed its share of the limelight as a trend definer.

These industries may be indicative of what is going on in other lines of activity but it must not be forgotten that even if they slacken there is no reason for other industries to follow suit. In other words, they are not the cause of prosperity nor of depression.

The real cause of our continued industrial activity, the greatly increased efficiency of our methods of production and distribution, is just coming to be recognized. During the post-war slump management suddenly awakened to the fact that its methods must be revolutionized if industrial units were to survive. The effect of this revolution is beginning to be felt. Production per individual and per machine has been stepped up, costs have been reduced and wages have been raised. The financial budget is now supported by sales and production budgets that are controllable.

Our underlying policies are sound. If we wish to continue to be active and prosperous we have but to carry them on, refining details as we go.

Machinery's Contribution to Health and Welfare

By E. F. DuBrul
General Manager, National Machine Tool Builders Association

ADAM SMITH'S book, "The Wealth of Nations," written in 1776, has had enormous influence on human thought, but at that time the great mechanical inventions were just coming into use and the great economist was mistaken in his theory that division of labor is the main factor in the increase of production per man hour.

There are two deeper principles, embodied in machines, that were overlooked and, due to a lack of clear understanding of these principles, progress has been slower that it would have been had they been understood. These two principles, formulated by Dean Dexter S. Kimball, were pointed out to engineers about eighteen years ago. They are: first, transfer of skill; and second, transfer of thought or intelligence from men to machines.

Many men say that these principles destroy craftsmanship. These men do not stop to think that every time a machine tool designer improves a machine tool his transfer of skill and intelligence to that construction relieves men of drudgery or allows a less skilled man to step into the ranks as that machine's operator.

Some idealizers, such as H. G. Wells, speak of chaining men to a machine or assembly line and want the good old days when a man could express his individuality and take pride and joy in his work. History, not of the imaginative kind, tells us that the good old days of handicraft were days of hard, twelve-hour, muscle labor at low wages. Then a few grandees lived in less luxury that millions now enjoy and the great mass of the people lived under conditions that we would not tolerate now for very long.

Developed Craftsmanship

The new trades that have come into being with machinery require a higher grade of mental ability than before. The tractor plowman is a more skilled craftsman that the man with the hoe and the craftsmen who built the tractor are more skilled than the man who can forge out a rough hoe.

The effective propaganda of the power companies is getting careless thinking people to believe that the application of power is the most important element in increasing production and that the power people are the ones who are applying the power that they produce. It is time to let the public see that power is merely an adjunct to the essential principles of transfer of skill and intelligence. How would these power companies get their power if mechanical men had not built the power making machines and the machine tools to make these? How would they sell power unless there were other machines made to which electric power is applied instead of muscle power?

Dean Kimball cites a drilling jig as a good illustration of the principles he formulated: To accurately drill four holes by hand in a steel plate, so that they bear a fixed relation to each other and to the edge of the plate, requires a high degree of skill. But to drill any number of plates so that the spacing of the holes in them will correspond closely with that of the first plate requires an extremely high degree of manual skill and is a lengthy and costly operation. If, however, a skilled workman makes a jig in which each plate can be securely clamped in the same position, any unskilled person can drill the plate as accurately as the most skilled workman.

The U. S. Coast Survey at Washington has a machine that calculates the tide tables for a year for each main point on our coast and the University of Wisconsin has a machine for calculating statistical relations. Both of these machines relieve a staff of people of much arduous labor with pad and pencil.

Machine Tool Increase

In 1812 this country had a population of 7,700,000 people. It took so much time to produce food that there was not much labor released for factory work until Cyrus McCormick's machinery came on the market about 30 years later. The per capita value of the country's manufactures was $22 a year, the total value being $170,000. In 1919 we had over 196,000 factories in this country employing over 10¾ millions of people more than the whole population of 1812. The value of the product was $62,000,000,000 or nearly $600 per capita.

During the span of 50 years from 1870 to 1920 the population increased 174 per cent, while the persons engaged in agriculture increased only 85 per cent. Today, seven years later, although we have at least 10,000,000 more people to feed, and although many of the 1920 farmers have gone to the factories, farm machinery enabled us to produce so much more per farmer that some crops have been overproduced to a disastrous extent.

In our mechanized world machine tools produce all consumer goods made of metal, they produce all the other machines used to produce goods made of anything else, they produce other machine tools. A progressive machine tool industry is necessary for the industrial progress of the country and for national defense. Machine tool builders have kept full pace with their colleagues in other mechanical lines.

Progress along engineering lines entails heavy costs and machine tool builders, unfortunately, have not been getting a fair return for their contribution to the advance in wealth and welfare. General business averaged 26 per cent better during the last four years than the machine tool business. Another bad symptom is the heavy mortality of machine tool concerns since 1920. If this mortality continues some machine tool users will have to become machine tool builders themselves.

There is only one remedy for this condition which is for the builders to get a price for the tools they sell that at least conforms to their costs, even though they generously give away the additional productivity that they have built into the machines. The world wants continually increasing amounts of consumer goods, but its enlarged wants will be supplied only because some men have the gift of ability to transfer more and more skill and intelligence from men to machines. The sooner these men realize their proper place in the general scheme of production, the sooner will they collect more nearly the hire of which their labor is worthy.

Abstract of address before Machine Shop Practice Session, Chicago Section, American Society of Mechanical Engineers, Mar. 16.

Shop Equipment News

"Monarch" 12-Inch Ball Bearing Jointer

THE "Monarch" 12-in. ball bearing jointer illustrated in the accompanying figures is being marketed by the American Saw Mill Machinery Co., Hackettstown, N. J. It is regularly furnished as follows: With ball bearings and motor on the head; with ball bearings and pulley for belt drive; with babbitted bearings and pulley for belt drive. Steel table lips or plain tables can be supplied.

The frame is cast in one piece, with wide-spread feet at the outfeeding end and with one central leg at the infeeding end, which gives clear foot room for the operator. By means of a crank, the infeeding table may be tilted to an angle of 5 deg. from the horizontal for use in pattern draft or other taper work.

The safety guard is of unusual design and is marked by three principal features: In its operating position the guard covers the head close up to the work, adjusting itself to any width; it can be held open by means of a latch when its use is not desired; or it can be thrown out of the way entirely for rabbetting without removing it from the machine. The fence is actuated by means of a cut rack and pinion, and when in position it is clamped fast. The fence has adjustment for alignment with the rabbetting edge of the table. It tilts to any angle from 45 deg. to vertical with positive stops for these positions. It has parallel traverse across the table.

The motor head shown in Fig. 2 is mounted in a heavy yoke which

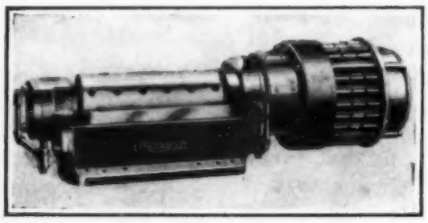

Fig. 2—The motor head

is doweled and bolted direct to the bed so that it cannot move out of line. The head itself is made of solid forged steel, 5 in. in diam., and is fitted with three high-speed knives, provided with screws for adjustment. The motor is for use on 60-cycle, 3-phase circuits. It is self-ventilating and is fully protected from chips and dust. Provision is also made to exclude dust and dirt from the ball bearings.

For connecting to a factory exhaust system, a cast-iron hood or chute is fastened to the under side of the yoke inside of the base, and to it an exhaust pipe may be connected. For individual exhaust a specially designed fan is placed inside of the frame and is driven by a small belt from the head shaft.

The feeding-in table is 48 in. long and the feeding-out table, 36 in., while the extreme length of the machine is 89 in. The width of the in-feeding table is 15½ in., and that of the out-feeding table, 13¼ in., while the extreme width over the motor and rabbeting arm is 38 in. The machine weighs about 1,600 pounds.

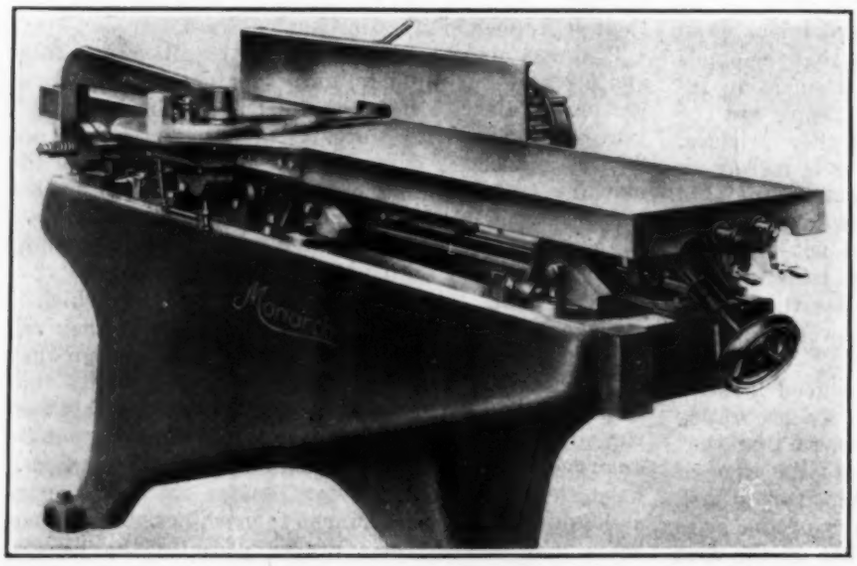

Fig. 1—"Monarch" 12-Inch Ball Bearing Jointer

Porter-Cable Combination Belt and Disk Sander and Grinder

The combination belt and disk grinder and sander shown in the accompanying illustration was designed by the Porter-Cable Machine Co., Syracuse, N. Y., for use in rough and finish grinding at the same time on the same machine.

The disk side of the machine has a table which tilts up and down through a range of 55 deg., or it may be removed entirely in order to use the entire face of the disk. An angle gage and a core print gage operating in a slot in this table make it possible to secure compound angles and also a variety of curves. The table measures 9x20 in. and is located 38 in. from the floor. The disk is 15 in. in diam. and operates at a speed of 1,725 r.p.m. An extra metal disk and six abrasive disks, together with cement, are regularly furnished with the machine.

The belt is driven by a pulley 7½ in. in diam. and runs over an idler 4 in. in diam. at the top of the machine. The belt side also has a table and angle gage which may be readily removed or tilted up 30 deg. or down 45 deg. It measures 7x4 in. The abrasive belt is 6 in. wide and with a pulley speed of 1,725 r.p.m. it travels at the rate of 3,300 ft. per minute.

When the table and upper dust gage is removed, pieces 18 in. in length or longer may be uniformly sanded by moving them back and forth along the belt. The bed under the belt may be placed in either a horizontal or vertical position by removing four capscrews. In this

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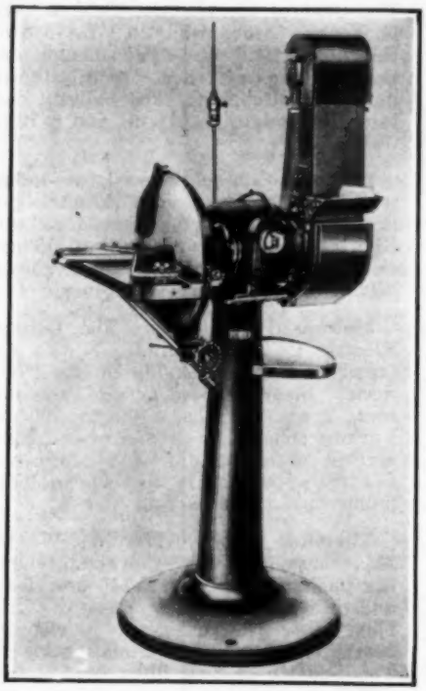
way the capacity of the machine is enlarged and it is made more convenient for certain operations. Two belts are furnished, one for wood and the other for metal.

A patented vacuum dust collecting system is built into this machine. It consists mainly of fans at the back



Porter-Cable Combination Belt and Disk Grinder and Sander

of the disk, which produce a vacuum in the housing and thus draw down the dust and force it through the pedestal to the floor.

Ball bearing construction is used throughout this machine so as to insure long life and absence of wear. A 3-hp. ball bearing motor furnishes the power to operate both the disk and the belt.

The machine occupies a floor space of 30x20 in. and is 60 in. in height. It weighs 300 lb. net.

Teer-Wickwire Full-Automatic Burr Cutter for Capscrews

The capscrew burr cutter illustrated is fully automatic and requires no attention other than the filling of the hopper. It is said that one unskilled operator can handle eight to ten machines. It is made by Teer, Wickwire & Co., Jackson, Michigan.

The screws are delivered by the hopper to parallel rails, down which they slide, hanging by their heads. At right angles to the rails is a reciprocating slide carrying the cutting tool, a gripping jaw, and a feeding finger. The cutting tool is made of a special grade of alloy steel and is heat-treated. It is held in the toolholder so that the point will spring. Ahead of the cutting edge are side guides which ride over the head of the screw to be burred. The cutting edge is at the low point of the side guides and between them. This arrangement combined with the spring of the tool causes the burr to be cut off flush with the top of the head, and also causes the screws to be prop-

Teer-Wickwire Full-Automatic Burr Cutter for Capscrews

erly burred even though the height of head varies $\frac{1}{16}$ in. either high or low.

On the forward stroke of the slide the side guides of the cutting tool pass over the head of the screw to be burred, pressing it down firmly against the rail. The gripping jaw then clamps the body of the screw and holds it rigidly while the cutting edge of the tool passes over the head and shears off the burr flush with the top of the head. On the return stroke the gripping paw releases the screw, and the feeding finger feeds the column of screws one space forward and places an unburred screw in position for the next stroke of the machine.

The machine is said to be exceptionally strong and rigid. All parts subject to wear are hardened or bronze bushed, and adequate provision is made for oiling. The reciprocating slide is 21 in. long, with bearing for its full length, and a gib is provided to take up wear.

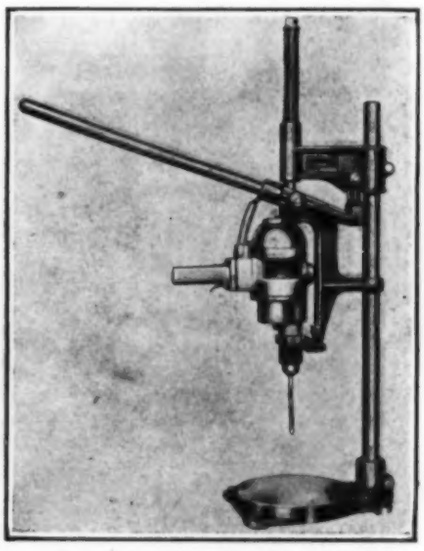
The drive of the machine is by belt from a lineshaft. Tight and loose pulleys 18 in. in diam. are designed to rotate at 100 r.p.m. The tight pulley also serves as a flywheel. Motor drive can be furnished at extra cost.

The standard machine will accommodate screws with body diameters ranging from $\frac{1}{4}$ to $\frac{5}{8}$ in., inclusive, and up to 5 in. in length. Two gripping jaws are necessary to accommodate the full range of the machine. One handles body diameters ranging from $\frac{1}{4}$ to $\frac{7}{16}$ in. in diam., and the other from $\frac{1}{2}$ to $\frac{5}{8}$ in. The machine is said to remove the burr from capscrews at the rate of 6,000 screws per hour. While it was designed primarily for this work, it will handle other automatic parts that can be picked up by the head.

The machine occupies a floor space of 50x45 in. It weighs 1,500 pounds.

Van Dorn Bench Drill Stand

The Van Dorn Electric Tool Co., Cleveland, Ohio, is marketing the bench drill stand, illustrated, for use with its $\frac{1}{2}$-, $\frac{3}{8}$- and $\frac{1}{4}$-in. portable electric drills. Two screws in the top head and two screws through a clamp bracket hold the drill rigidly in place.



Van Dorn Bench Drill Stand

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The design is such that the line of pressure is brought directly over the twist drill. A tension spring lifts the drill out of the work instantly when the handle is released.

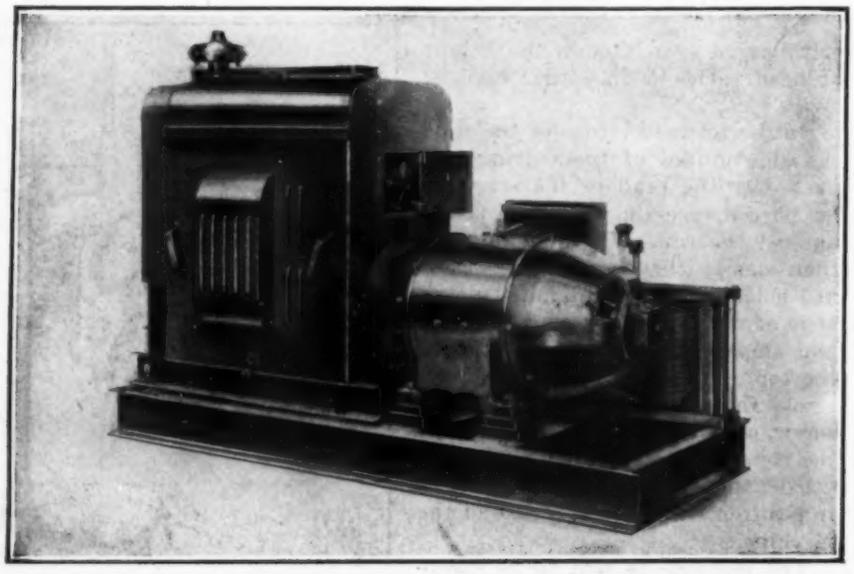
The stand weighs 56 lb. Its shipping dimensions are 40x11x15 inches.

General Electric Gas Engine Driven Welder

The General Electric Co., Schenectady, N. Y., announces another addition to its line of welding equipment. The small gas engine driven welding outfit, shown in the accompanying illustration, incorporates a General Electric WD-11 welding generator driven by a Continental P-20 gasoline engine.

The generator has a continuous rating of 150 amp. and a 1-hr. rating of 200 amp., the complete current range running from 50 to 250 amp. The driving motor is rated at 18.22 hp., S.A.E., but is capable of developing 23.5 hp. at 1,400 r.p.m. The generator is equipped with a control panel, rheostat and self-adjusting stabilizing reactor. The engine accessories include a strongly constructed radiator, a pressure feed lubricating system with gage and indicator, a gravity feed carburetor, air cleaner, centrifugal governor, 10-gal. gasoline tank, tool box and sheet metal hood with side panels that can be locked in place.

The outfit is particularly adaptable for oil field work, shops and garages where portability is desirable or where no power supply is available for driving a motor-generator type of welder. Among the advantages claimed for this unit are low first cost, light weight, and reliability. It is said that the outfit is capable of standing up under hard service and overloads. It is mounted complete on a structural steel base designed to facilitate easy moving from place to place.



General Electric Gas Engine Driven Welder

Trade Catalogs

Conveyors and Transmission Machinery. The Stephens-Adamson Manufacturing Co., Aurora, Ill., recently published its General Catalog No. 30. This is a 960-page book containing many blueprints, descriptions, and technical data concerning conveying, elevating, screening, and transmission machinery. It is bound in flexible black covers and is 5½x8½ in. in size. It is completely indexed.

Conveyor belts are first listed, followed by chain for elevating, conveying and the transmission of power, then gears, spur, bevel and worm. Pan conveyors and bucket elevators, together with allied equipment such as unloaders, are taken up in turn. Transmission machinery includes clutches, pulleys, sheaves, hangers and speed reduction units.

Drill Chucks. The Union Manufacturing Co., New Britain, Conn., has published a leaflet on its "New Britain" drill chucks. Ten features are stressed. The bulletin is well illustrated.

Electric Furnaces, the Wild-Barfield. The Automatic & Electric Furnaces, Ltd., 173 Farringdon Road, London, E.C.1, England, has published Section H of its catalog. The booklet contains sixteen 8½x11-in. pages and is well illustrated throughout with photographs. Rectangular and oval horizontal furnaces, circular vertical type, crucible, and laboratory tube furnaces are described in turn. Control panels and pyrometers are also listed.

Gears for Centrifugal Compressors. The General Electric Co., Schenectady, N. Y., has issued Bulletin GEA-588 on the above subject. The design and manufacture of these gear step-up units are discussed. The bulletin contains four pages, 8½x11 in., and is illustrated.

Heating, Control Panels for Industrial Electric. The General Electric Co., Schenectady, N. Y., has issued Bulletin GEA-594 on the above subject. Three sizes of control apparatus are shown. Wiring diagrams are also given.

Motors, Synchronous. The General Electric Co., Schenectady, N. Y., has issued Bulletin GEA-708 on its "7600 Series" medium-speed synchronous motors, 2 and 3 phase, 100 to 700 hp. Various constructional features are described with the aid of photographs. Control apparatus is also shown. The publication contains four pages.

Tumbling Mills. The W. W. Sly Manufacturing Co., Cleveland, Ohio, has published Bulletin S-136 describing and illustrating three sizes of "Slyblast" tilted mills for use in cleaning castings, forgings and similar material. The bulletin is well illustrated and in addition complete descriptions and specifications are given. It contains eight pages, letter size.

Pamphlets Received

Lectures on Engineering Practice. The Johns Hopkins University, School of Engineering, Baltimore, Md., has published in booklet form two lectures delivered in 1926. One, entitled "How Long Shall We Live?" was delivered by C. F. Hirshfield and concerned itself with a philosophical study of the possible limit of our natural resources. The other was presented by C. W. Hewlett. His subject was "Electron Currents through a Vacuum and through Gaseous Atmospheres." It is highly mathematical in treatment. The pamphlet is 6x9 in. in size and is bound in paper covers.

Social Science. The Social Science Research Council, Chicago, Ill., has published its annual report through its chairman, Prof. Charles E. Merriam, University of Chicago. Various committee reports are given, the organization is outlined, and the present and future policy stated. Of interest to manufacturers is the study of "The Relation of the Mechanization of Industry to Migration," now being pursued.

NEWS OF THE WEEK

Industrial Slump and Unemployment Retard Recovery of the Franc

Machinery trades show only slight improvement

BY OUR PARIS CORRESPONDENT

MONSIEUR POINCARÉ stated recently before the chamber of deputies that it is impossible to look for an immediate stabilization of the franc under present trade conditions. On the first of January it stood practically at 25 to the dollar; today it has lost the better part of a franc again, which may be taken merely as an anticipated fluctuation if not a normal one. The status is expected to remain pretty much what it is for some time to come.

The unemployment statistics as given by the *Journal Officiel* last week show 73,609 men and women receiving government aid, as compared with 64,500 the week before. There has been less increase in unemployment in the Paris district than elsewhere, and the crisis is thought to have reached its maximum. In the Nord department a sheet mill has laid off 150 employees and many makers of tools and machinery are working but five days a week, as is true of the automobile industry, where, as in some cases, it is even shorter time. In the Grenoble district there are 32,500 workers affected by partial slowdown, of this number five thousand are foreign laborers. An agricultural machinery plant employing 800 workers is shut down two days a week. The situation is stationary in the Loire valley.

Machine wire and nut and bolt makers are in a period of readjustment of prices which will enable them to meet foreign competition both at home and abroad. The latter industry has been obliged to increase its discounts from list and has secured some volume of railway business. There has been some revival in the tin can and metal receptacle line and the stamping plants of the Ardennes are finding a seasonable business increase.

The tool and machinery trades have been hard hit for some months but for the moment are more active though still far from normal. In general it may be said that the crisis in the automobile trade largely accounts for the situation. Drills and punches have undergone a price revision downward. The recent agricultural machinery exposition at Paris has served to show the notable progress which French makers have made. Imports, aside from those from the United States and Canada, are now arriving in these lines from Czecho-Slovakia and Austria, which projects a new element in the trade.

Imports of tools and machinery from the United States during 1926 show increases over the year before in every classification. Exports from France to the United States of "tools and fabrications of metal," show nearly a 100 per cent increase over the figures of 1925.

Excepting with respect to the first item of imports from the United States the values were not notably increased, while the last item of exports to the U. S. the figures nearly doubled. Tonnage figures in neither case are so imposing, for these franc quotations based on the French customhouse figures, are of course valued on the paper franc standard, and for six months of 1926 the franc was 50 per cent lower than it was just previously, or is today.

FRENCH IMPORTS AND EXPORTS OF TOOLS AND MACHINERY IN 1926

	EXPORTS (In metric tons)	IMPORTS (In metric tons)
Printing Presses		
Germany	94	839
Italy	68	43
Other countries	483	497
Accessory Printing and Paper Machinery		
Germany	17	646
Brazil	196	nil.
Other countries	179	465
Agricultural Machinery		
Sweden	18	3,428
Germany	154	771
Canada	42	15,190
Belgium-Luxembourg	4,048	3,985
United States	116	24,765
Great Britain	843	1,064
Other countries	14,098	948
Machine Tools		
Germany	343	3,858
United States	40	2,192
Great Britain	624	964
Italy	620	96
Switzerland	392	1,017
Other countries	9,577	8,122
Sewing Machines (*without base*)		
Germany	3	765
United States	4	106
Great Britain	5	1,224
Other countries	125	49
Typewriters and Adding Machines		
Germany	3	29
United States	2	537
Great Britain	7	76
Other countries	166	43
Milling Machinery		
Germany	2,030	2,252
Belgium-Luxembourg	5,720	1,143
Other countries	28,766	1,651

OTHER ITEMS NOT SPECIFIED BY COUNTRIES—EXPORTS AND IMPORTS, 1926

	EXPORTS (in metric tons)	IMPORTS (in metric tons)
Navigation motors, steam and oil Fixed motors, steam and oil Steam pumps	4,439	6,619
Road tractors	7,041	8,603
Field tractors	702	186
Hydraulic machinery	4,774	2,482
Distilling and heating appliances	966	86
Refrigerating machinery	847	492
Hand tools, files, vises, etc	14,597	1,094
Saws, circular, ribbon and hand	1,198	340

Many of these items suggest the progress which France has made since the war in her export trade but various items of importation being re-exported the figures are on the whole to be discounted somewhat. Since the figures are given in metric tons, the fluctuating value of the franc during the past year has not to be taken into consideration with respect to either exports or imports.

INCREASES AND DECREASES OF EXPORTS AND IMPORTS OF MACHINERY, ETC., IN FRANCE AS COMPARED WITH 1925

The following imports show decreases:		
Agricultural machinery	8,000	tons
Sewing machines	200	tons
Milling machinery	700	tons
Refrigerating machinery	72	tons
Hand tools, etc	360	tons
Saws	200	tons
The following imports show increases:		
Printing presses	17	tons
Accessories	94	tons
Machine tools	1,680	tons
Typewriters	76	tons
Navigating motors	112	tons
Road tractors	1,880	tons
Field tractors	46	tons
Hydraulic machinery	900	tons
Exports increased in tonnage over 1925 as follows:		
Printing presses	166	tons
Accessories	13	tons
Agricultural machinery	4,711	tons
Sewing machines	3	tons
Machine tools	255	tons
Navigating motors	1,440	tons
Hydraulic machinery	1,132	tons
Refrigerating machinery	89	tons
Hand tools	2,364	tons
Saws, etc	379	tons

It is interesting to note that the total export tonnage of machine tools, hand tools, saws, files, etc., increased during the year by 2,998 tons while imports of the same items are recorded as having increased but 1,120 tons. This shows French progress in this line though it is more than probable many of the exports were imports re-exported, especially with regard to machine tools and agricultural machinery. Total exports of these three items are set down as 27,391 tons, as compared with 20,599 tons imported.

It is remarkable that the import figures for January, 1927, just received, show an increase of manufactured articles, over those of December, 1926, of but 8,081 tons; exports increased 75,909 tons of a value of 467,888,000 francs.

Dunbar Will Address Russian Engineers

On the evening of March 31 at the Engineering Societies, Building, New York City, Howard W. Dunbar, assistant general sales manager of the Norton Co. will deliver a talk before the general meeting of the Russian Association of Engineers. His subject will be "Some High Lights in Grinding."

Mr. Dunbar will bring out in his talk some very interesting facts concerning the importance of grinding as a major machine operation, by drawing comparison between the present methods of producing work as compared with methods in vogue 25 years ago.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

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MORE than 100 years ago an English Archbishop, Dr. Whately, wrote a pamphlet in which he undertook to prove that Napoleon was a myth. His purpose was to discredit agnostic attacks upon Christianity by showing that even the obvious could be disproved. He nearly succeeded, for a doubt of Napoleon's existence will almost certainly be felt by anyone who reads the Archbishop's thesis.

With a few changes the Archbishop's illogical logic might be applied to the business situation in America. It is so mixed that any interpretation of it can be supported or demolished by facts. In some of its aspects it seems to warrant unbridled optimism while in others it is far from encouraging. Take the headings of the various trade reports, for instance. Here are some of them:

Wholesale trade lowest since 1922.
Chain store sales gain in February.
Spottiness marks trade conditions.
Failures decline 17 per cent in February.
Mail order firms report decline in February sales.
Bradstreet's thinks situation somewhat spotty.
Business is speeding up.
Trade conditions in West improving.
Business failures continue to be large.
Better February trade in Philadelphia.
Cleveland bank finds trade below 1926.
Mail order houses show good sales to farmers.
Business gains are noted in Chicago.
Three banks fail in Palm Beach, Fla.

And finally the Federal Reserve Board, reporting for the whole country, says that the February sales of 568 department and other retail stores were 2½ per cent larger than February last year. But it is added that wide variations in sales were shown in different sections of the country. In Boston and Atlanta the increase was 6 per cent while in the Dallas district there was a decrease of 10 per cent.

The reports of railroad earnings, car loadings and bank clearings are almost as confusing as the trade returns above quoted. Thus the Pullman Co. reports a deficit of $510,000 for the quarter ending Jan. 31. It is attributed in part to a decrease in travel. The net operating income of the railroads for January was 3¾ per cent under last year. The car loadings for the week ending Feb. 26 show an increase of 10,914 cars over last year, but as the coal traffic exceeded that of 1926 by 20,489 cars, the loadings of merchandise other than coal were 1½ per cent under last year. This has been true of car loadings for some time. Bank clearings for the first week of March as reported by *Dun's* were 2.3 per cent under last year.

WHAT'S DOING IN INDUSTRY

A STEADINESS that is almost monotonous characterizes the present trend in machinery and machine tool activity. Sales are reported better in some industrial centers, while in others the curve is downward. March volume, from the present outlook, will not reach estimated proportions.

CINCINNATI reports an upward trend, sales and inquiries increasing slowly but more evenly. Milwaukee shows some signs of improvement, with inquiries forecasting a good future sales volume. There is little change from the desultory buying of recent weeks in Chicago, and Detroit is becoming reconciled to the belief that automobile manufacturers are not going to place large orders for shop equipment this year. A better tone is reported from Cleveland, where both sales and quotations are improving.

NEW ENGLAND is optimistic with the receipt of some substantial business paving the way for a busy summer. New York is less happy, but some good prospects are in sight. Sales are slow in the Buffalo district and Philadelphia notes a slight retraction in the current business expansion.

CHEAP and abundant credit is expected to act as a shock absorber in the general business world. But at times in the past we have had dull times with cheap money, and it may be that history will repeat itself in the present year.

But to relieve the confusion of mind which the foregoing may create, it might be pointed out that it is predicted that over 300,000 American tourists will visit Europe during the coming season and that more than 500 steamships will be required to convey them. Another indication of American spending power is the statement that we are now spending more than $275,000,000 a year for cosmetics. And further evidence of our apparently inexhaustible wealth and the insatiable demand for sound investments is furnished by the success that has attended Secretary Mellon's refunding operations announced last week. The ease with which these refunding operations have been conducted is regarded by many as guaranteeing cheap money for a long time.

But here again we meet a paradox. If we are to have cheap money as long as the recent developments seem to indicate there is no reason why investment securities should go any lower. Nevertheless a liquidating disposition is discernible among some of the shrewdest investors. We must look below the surface for an explanation. Some of them say that they expect a decline in the earnings of industrial corporations, while others call attention to the inaction of the Interstate Commerce Commission upon the various consolidation plans thus far submitted to it and point out that any railroad consolidation of importance is not to be expected until Congress compels the railroads to come together along the lines suggested in the Transportation Act.

In the industries the fact that unfilled orders of the U. S. Steel Corporation declined 203,000 tons during February has not prevented it from increasing operations again and the output of the independent mills also shows gains, while prices in several lines have been marked up.

George Eliot said that "a man's philosophy is the formula of his personality." Thus many men can see as many things in the business picture. But men of all personalities must agree that the support of cheap and abundant credit dominates at least the background of the scene depicted.

That it will act as a shock absorber may be taken for granted but in the past we have sometimes had dull trade with cheap money and it may be that history will repeat itself. At all events there is no boom in sight.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

CINCINNATI

Machine tool manufacturers of the Cincinnati district report that during the past week business held up in a satisfactory way. The majority of concerns report a slight increase in sales and none report a decrease. Selling agents report that the market is showing signs of growing livelier.

The major part of the week's orders called for single tools and replacements. These came from all kinds of users, located in all sections of the country, and called for practically all varieties and sizes of tools. The purchase of high-efficiency tools to replace obsolete equipment was a feature. Railroads and concerns in the automotive industries confined their purchases almost entirely to single tools.

Several manufacturers report that inquiries were exceptionally good during the week, the greater part of these being for single tools for replacements. The only railroad list reported came from the Santa Fe.

The general feeling of the trade, based on the number and tone of the inquiries coming in, is that business is on the upgrade and the demand will increase.

CHICAGO

Conditions in the machine tool industry continue without change. No perceptible improvement in the market has been noted during the last week, business being on about the same level as for a month past. On the other hand, there has been no decrease in the volume of trade, a situation regarded as favorable.

Railroads are being depended on more than any other industry as a prospective source of activity in the movement of machinery in the immediate future. Roads that have not issued lists for some time are reported to be preparing to enter the market for needed shop equipment within the next thirty days. Among the roads which have sent out lists recently, the Santa Fe leads with an inquiry for 17 tools of various types. The St. Louis & San Francisco also is reported as making inquiries for a number of tools.

The automotive industry thus far in March has shown no signs indicative of any present intention to buy new equipment except for replacement purposes, and the same thing may be said of agricultural implement manufacturers. Industrialists and owners of machine shops continue to be the principal dependence of dealers.

MILWAUKEE

Signs of improvement in the demand for metal working equipment are discernable, but with the automobile industry still inactive as a group, compared with a year ago, the volume of bookings remains somewhat restricted. Inquiry is reported as being moderately active, but prospective buyers are slow in closing. No customer is buying quantities, business being composed of a large number of small orders.

With few exceptions, metal working concerns are limiting their purchases to needed replacements rather than to effect any material increase in their capacity. The conservatism of recent months is still apparent, although it is beginning to lift as the foundry and machine shop industry emerges from a period of reduced activity.

General manufacturing is in process of improvement and expressions of opinions daily become more cheerful and encouraging. While local manufacturers of tools have been experiencing a moderately satisfactory business from railroads, they are hopeful of a decided betterment, an expectancy based on the more active inquiry of the past few weeks.

CLEVELAND

Improvement was noted in several branches of the machinery and machine tool industry during the first ten days of March. More activity and an increase in sales are reported. Although no large orders have come into the market it is noticeable that buying is becoming more general. General machinery, metal working, farm implement, electrical, automobile and automobile accessory concerns were recent buyers. More interest is being shown at the present time.

Inquiries are more of an encouraging nature, larger lists of tools are being called for and date of delivery is requested. It is the general opinion that a "spring-buying" period is at hand.

The most outstanding feature of the past fortnight was the purchases made by Dodge and Chevrolet. It is expected that other automobile manufacturers will soon issue lists. Production of machinery is about 60 per cent of normal capacity.

NEW ENGLAND

An order for machinery and tools, to be made in Hartford for the Japanese government is one of the largest contracts received in the New England territory so far this year. This contract, together with regular business, assures active operations in one plant for the rest of the year, but will not involve additional employment or overtime work.

Better buying on the part of the automotive industry appeared in the last fortnight and there was also buying on the part of Middle-West railroads. Small tool manufactures say that the volume of orders booked shows improvement and the consensus of opinion is that March business will exceed February business, which was better than the January total.

DETROIT

Market conditions in the machine tool and machinery field in Detroit remain rather unsettled. What buying there is, has for the most part been confined to single tools and machines for replacements, with here and there an order of larger size. Automobile manufacturers are agreed that 1927 will be a crucial year for the industry, with the question of the survival of the fittest being much more in prominence than for some time past. As a consequence there is a disposition on the part of a large number of plants to cut to a very minimum all purchases of new equipment wherever it is possible.

The one noticeable exception to this continues to be the General Motors plants. The new LaSalle has just made its initial bow and a heavy production schedule for this new model is now under way. At the Oakland and Pontiac plants the policy is to buy wherever production may be speeded up and man power cut down.

The sudden collapse of the negotiations between Briggs and Murray, whereby these two body manufacturers would have merged, will mean that buying in the body field will play a big part in the machinery picture for the next two or three months.

PHILADELPHIA

The absence of substantial orders either from the railroads or from the automotive industry, caused machinery and machine tool manufacturers and dealers in the Philadelphia district to report a dull period during the last two weeks.

A few orders have come from industrial firms to producers of forging hammers and slotters, and some single machines have been sold to other establishments. Notwithstanding the lack of buying in large quantities, some of the biggest producers forecast an increase in volume for March.

Some inquiries have come from railroads which indicate there may be some buying. The Baldwin Locomotive Works is operating at 40 per cent of capacity, and it was said this week that officials hope to increase that to 50 per cent shortly.

BUFFALO

The machine tool trade in Buffalo during the last week of February and the first part of March was dull. As this is written the condition of business can best be characterized as spotty. Some dealers report signs of improvement. After March first inquiries became more frequent. Most of the orders placed recently have been for single items and many of them have followed inquires of long standing.

The electrical equipment division of the tool trade is quiet, although conditions are slightly better than in February. The demand for contractors' equipment is slight but this sag is considered of a seasonable nature and no importance is attached to it.

NEW YORK

Sales in this market continue spotty, and there has been a slight dropping off in inquiries. There have been no large orders placed and no new lists of any size issued. Most of the present business is confined to orders for individual machines, purchased to replace obsolete models, or to enhance production. There is, however, a better price tone to the market, buyers showing less tendency to quibble over quotations.

Some railroad business was placed, including an order from the New York Central for 4 grinders and one from the Boston & Maine for 2 grinders. The Philadelphia Rapid Transit bought a large lathe. The New Departure Manufacturing Co. bought a sliding gap lathe, the Bridgeport Machine Co. a Duplex milling machine, Brown & Sharpe a vertical surface grinder, and the Delco company a jig borer. Another large manufacturer purchased 5 automatic lathes and 2 centering machines. A 30-in. profiler a bench miller, a drill and a grinding machine went to another. The First National moving picture organization bought a drill press and a lathe.

With the first half of the month finished the total volume of business is below the estimated figure. It is considered unlikely that enough business will materialize in the next two weeks to make up that loss.

Rules for the Lincoln Arc Welding Awards

The American Society of Mechanical Engineers has announced the rules and regulations to govern the competition sponsored by the Lincoln Electric Co., of Cleveland, Ohio. The sum of $17,500 has been placed in the custody of the society. This sum is divided into three prizes or awards of $10,000, $5,000 and $2,500 for a world wide competition for the three best papers disclosing the advancement in the art of welding. The A.S.M.E. will appoint a committee of judges who will pass upon the relative merits of the papers and recommend the awards.

The competition is open to anyone in any country in the world. All papers must be written in duplicate, in English, and submitted to the council of the society, addressed to the society at 29 West 39th Street, New York City. All papers must be sent before Jan. 1, 1928. Each paper should have the necessary drawings and photographs and exhibits that complete the story. The text should show the utility, economy and practicability of the suggestions contained therein. Each paper should be 8x11 in., bound at the top, and carry the name and address of the competitor on the front cover. Both copies should be sealed in an envelope, on the outside of which is the name, address of the sender and the following legend: "Submitted to the A.S.M.E., 29 West 39th Street, New York City, in competition for the Lincoln Arc Welding Prize." No paper will be returned and the society reserves the right to publish any of the papers it may select.

It is the intention of the A.S.M.E. to present the awards in this competition at the stated 1928 spring meeting of the society. Copies of the brochure setting forth the complete regulations may be had from C. W. Rice, secretary, A.S.M.E., 29 West 39th St., New York.

Citroen Takes Over German Plant

The Citroen Co., important French producer of small automobiles, has purchased the German plant known as the "Rheinwerk Koeln-Poll Fabrik fuer Eisenbahnbedarf," at Cologne, consisting of a site of 15.6 acres and embracing every modern facility for the manufacture of motor car bodies and railway cars.

The Citroen company is converting the plant to the exclusive production of the 10-hp., four-cylinder car which, for the present time, will be assembled from parts imported from France. It is reported, however, that the company intends gradually to proceed to the production of complete cars at its Cologne works with the exception of the motors which will continue to be supplied from France. Such a plan would effect a considerable saving in customs duties.

During the years following the World War, French manufacturers of automobiles succeeded in establishing a foothold in the automotive market of western Germany, particularly in the sale of light cars of the sport type, a report to the Department of Commerce states. However, the imposition of import restrictions after the re-establishment of German customs control in that region presented an obstacle to this trade and the Citroen company, among others, found itself confronted with a heavy decline in German sales. The efforts of the German automotive industry to recover from the period of depression through which it has passed has presented another problem to the French automobile producers. The recent acquisition of the German plant by Citroen is believed, in Germany, to be an attempt to overcome these difficulties.

The new plant will commence operations with a force of approximately 350 workmen, and a daily production of fifteen cars. The production figures, it is said, are likely to be increased with the expected development of the market.

French Automotive Engineers to Organize

What is regarded in France as an important step in the development of the French automotive industry was taken recently when the preliminary organization of a "Societe Francaise des Ingenieurs de l'automobile et de l'Aviation," similar to our own Society of Automotive Engineers, was started.

At the organization meeting in Paris, a large number of engineers were present, including many important personages in the industry. After speeches outlining the importance of the movement, formation of a group uniting all the French automobile and aircraft technicians was unanimously voted. A committee was appointed to prepare detailed plans and a "secretariat" was ordered established at 102 rue La Boetie, Paris.

Until the present time, French automobile and aeronautical engineers have worked entirely independently despite the fact that many questions of common interest could be solved by a technical organization. Potential benefits of the new society have been outlined as follows: Assisting the progress and development of the automobile, aeronautical and allied industries; grouping and centralizing for study and discussion all documents concerning the said industries; establishing a technical relation among the members of this association.

To Avoid Wastes in Bolts and Nuts

Plans for reducing avoidable waste in the distribution of bolts and nuts by eliminating needless sizes of containers in current use for handling, packing and shipping will be considered at a general conference of all interests at Washington on March 23, according to an announcement issued by E. W. Ely of the National Committee on Metals Utilization, Department of Commerce.

The tentative list of standards to be submitted to the conference for consideration and adoption have been arrived at after a careful study of orders received, and represents a reduction to a practicable minimum.

Plan Aircraft Show in Washington

Plans to hold an exhibition of aircraft and aircraft accessories in Washington, early in May, were formulated last week at a conference held by the Department of Commerce between government officials and representatives of the aeronautical industry and trades. A resolution was adopted requesting the Aeronautical Chamber of Commerce, through its flying and show committee, to recommend the scope and plan for the exhibition and to mobilize the industry so that the contemplated exhibition will assume proportions commensurate with the importance of the event. No contests will be staged in connection with the exhibition, the conference decided.

Canada will be invited to send representatives to this exhibition. The following were appointed a committee to make local arrangements for the exhibition, including the designation of landing field, hangar space and other essential features, and to co-operate with the committee of the Aeronautical Chamber of Commerce: James A. Summers, representing the Aeronautical Branch of the Commerce Department; Major G. W. Fitzgerald, U. S. A., representing the air corps of the Army; Lieut. R. A. Ofstie, representing the Bureau of Aeronautics of the Navy; Dr. G. W. Lewis, representing the National Advisory Committee for Aeronautics; Porter Adams, representing the National Aeronautic Association; A. T. Stewart, representing the U. S. Chamber of Commerce; Halbert E. Payne, representing the Atlantic Aircraft Corporation; A. E. Nesbitt, representing the Fairchild Aviation Corporation, and I. M. Day, representing the General Electric Co.

Ten Years Progress in Safety Work

Philip C. Staples, vice-president of the Bell Telephone Co. of Pennsylvania, told Philadelphia Rotary Club members at a meeting on March 9, that the company's industrial accidents have been reduced from 12.2 per 100 employees in 1916, to 0.58 in 1926, through the activity of the company's first aid crew.

An ambulance crew of four physicians, skilled in the manner of administering aid in emergencies, is kept constantly in readiness to respond to all kinds of calls. Frequently, Mr. Staples said, the ambulance crew, while out on company business, encounters motor car accidents and although it may be no affair of the company, the crew renders first aid and takes injured persons to hospitals.

Since the crew was organized ten years ago 6,000 emergency cases have been treated, and 70 lives have been saved, Mr. Staples said. Machinery accidents and accidents to linemen are the most frequently treated. In 1916 there were 195 safety meetings of employees. The popularity and interest in the work increased each year until in 1926 there were 6,631 such conferences in various places under the company's jurisdiction. The company plans to expand these activities this year.

Personals

ARTHUR SIMONSON has been elected vice-president of the Falk Corporation, of Milwaukee.

C. J. STURGEON has become associated with D. C. Oviatt & Co., of Cleveland, machinery dealers.

S. B. GOLDMAN has been appointed auditor of the Southern Pacific R.R. Co. of Mexico.

J. E. DORAN, consulting engineer, has been appointed sales manager of the G. A. Gray Co., of Cincinnati, manufacturer of planers.

DUFF A. ABRAMS, for many years director of research for the Portland Cement Association, has resigned. F. R. McMillan has succeeded him.

JOSEPH F. SAMPLE, of 23 South 52nd St., Philadelphia, is now representing the Wetmore Reamer Co., of Milwaukee, in that territory.

H. E. OBERG has been appointed manager of sales in the Mid-West for the Billings & Spencer Co., of Hartford, Conn. His headquarters will be in the General Motors Bldg., in Detroit.

TELL BERNA, formerly sales manager for the G. A. Gray Co., of Cincinnati, manufacturer of planers, has resigned that position and has become sales manager for the Union Twist Drill Co., of Athol, Mass.

E. A. FISCHER has been appointed advertising manager for the Kearney & Trecker Corporation, of Milwaukee. Mr. Fischer had previously been connected with the Worthington Pump Co., the Kempsmith Manufacturing Co., and C. Niss & Co. He will be assisted by Joseph Trecker.

B. M. SLICTING has been appointed sales promotion manager for the Trico Fuse Manufacturing Co., of Milwaukee. This company also announces the appointment of J. E. Eldredge as sales representative in Connecticut and the western part of Massachusetts; and Arthur Bacon in Colorado, New Mexico, Utah and Wyoming.

Bakelite Caravan of Ideas

There is at present on tour in the central states a traveling exhibit showing the many and varied uses of Bakelite in industry. Some two hundred manufacturers who use Bakelite in their products are represented in the exhibit, which during March and April will cover important industrial centers in Ohio, Michigan and Indiana. As the caravan reaches each stated stopping place, invitations are issued to engineers, manufacturers and to the public at large to visit the show, which is usually held in one of the large hotels. The exhibit is under the direction of the Bakelite Corporation, of New York.

Business Items

The Mahr Manufacturing Co., of Minneapolis, Minn., has moved its New York offices to 55 West 42nd St. Ray G. White continues in charge.

The Keystone Aircraft Corporation is the new name adopted by the recently reorganized Huff Daland Airplanes, Inc., of Bristol, Pa.

Hollis & Co., 305-11 E. Markham St., Little Rock, Arkansas, have been appointed distributors for the city of Little Rock and vicinity.

The Link-Belt Co., of Chicago, announces the opening of a new branch office at 229 Brown-Marx Bldg., Birmingham, Ala. W. H. Norton, for many years connected with the Chicago sales organization, will have charge of this branch. Harold R. Haught will be his assistant.

The Shepard Electric Crane and Hoist Co., of Montour Falls, N. Y., desiring a closer co-ordination of its motor supply with its electric crane and hoist business, has appointed Fred G. Bell to direct this new development. Mr. Bell was formerly president and general manager of the Zobell Electric Motor Corporation, Garwood, N. J.

Micarta Fabricators, Inc., 307-11 Canal St., New York, has taken over the entire business and personnel of the Accurate Gear Corporation, of 273 Sackett St., Brooklyn, N. Y., and has created a new division of the general sales and engineering departments known as the Accurate Gear Division. Joseph J. Braun has been made chief engineer of the company and general manager of the Accurate Gear Division. The plant of the Accurate Gear Corporation has been moved to 307-11 Canal St., New York, where the combined companies will have their general offices and plant.

Obituaries

LELAND L. SUMMERS, widely known as a consulting engineer and an expert on munitions, died on March 10 at his home on Long Island, N. Y. Mr. Summers is best remembered for his services to the Government during the World War.

CHARLES M. BROWN, SR., president and chairman of the board of directors of the Colonial Steel Co., of Pittsburgh, died after a brief illness on March 9. Mr. Brown had been associated with the steel industry for many years, starting with the Howe-Brown Co., later with the Crucible Steel Co., and in 1913 joined the Colonial Co.

Calendar of Local Meetings

National Association of Cost Accountants

Boston Chapter. March 17. "Cost Analysis as a Means of Detecting Waste in distribution Costs," by W. B. Castenholtz.

Buffalo Chapter. March 24. "Accounting Problems in the Operation of Standard Costs," by F. L. Sweetser.

Chicago Chapter. March 17. "What Standard Costs Can Do for the Production Department," by H. M. Tompkins.

Detroit Chapter. March 24. "Cost Accounting for Automobile Bodies," by L. D. Crusoe.

Erie Chapter. March 21. "Mechanical Aids to Cost Accounting."

Hawaii Chapter. March 28. "Home Industries for Hawaii," by George Bustard.

Kansas City Chapter. March 21. "Merchandise and Stores Control by Lots — Method of Handling Mechanical Appliances Demonstration."

Milwaukee Chapter. March 17. "Materials Control," by Lawrence G. Regner.

Philadelphia Chapter. March 18. "Operating Ratios and Capital Turnovers as Found in Various Lines of Business."

San Francisco Chapter. March 28. "Accounting and Statistical Control of Industry—Executive Use Thereof."

Scranton Chapter. March 22. "Optional," by C. M. Finney.

Utica Chapter. March 21. "Wage Payment Plans and Bonuses."

Society of Automotive Engineers

Metropolitan. March 17. "Trucks," discussion by chief engineers of several truck manufacturing companies.

Washington, D. C. March 18. Air Transport Dinner—"Air Transport in Europe," by Major Lester D. Gardner.

Detroit. March 24. "Artificial Leather and Rubberized Products," by E. H. Nollau and Mr. Nickowitz.

Forthcoming Meetings

American Society of Mechanical Engineers. Regional meeting, Kansas City, Mo., April 4 to 6. C. E. Davies, secretary in charge of meetings, 29 West 39th St., New York.

American Gear Manufacturers Association. Eleventh annual meeting, Hayes Hotel, Jackson, Mich., May 12 to 14. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

American Society for Steel Treating. Spring sectional meeting, Milwaukee, Wis., May 19 and 20. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

American Society of Mechanical Engineers. Semi-annual meeting, White Sulphur Springs, W. Va., May 23 to 26. C. E. Davies, secretary in charge of meetings, 29 West 39th St., New York.

National Foreign Trade Council. Fourteenth national foreign trade convention, Hotel Statler, Detroit, Mich., May 25, 26 and 27. O. K. Davis, secretary, India House, Hanover Square, New York.

Society of Industrial Engineers. Annual meeting, Hotel Stevens, Chicago, May 25, 26 and 27. George C. Dent, secretary, 608 S. Dearborn St., Chicago, Ill.

Society of Automotive Engineers. Summer meeting, French Lick Springs, Ind., May 25 to 28. C. E. Heywood, manager of meetings department, 29 W. 39th St., New York City.

National Association of Purchasing Agents. Annual meeting and "Informashow" at Grand Rapids, Mich., June 6 to 9. W. L. Chandler, secretary, Woolworth Bldg., New York City.

American Foundrymen's Association. Annual convention, Edgewater Beach, Chicago, June 6 to 10. R. E. Kennedy, secretary, 909 W. California St., Urbana, Ill.

National Supply and Machinery Distributors' Association. Twenty-second annual convention with the **Southern Supply and Machinery Dealers' Association,** and the **American Supply and Machinery Manufacturers' Association,** on board the steamship *Noronic.* Boat leaves Detroit, Mich., June 13 and returns there June 17. George A. Fernley, secretary, 505 Arch St., Philadelphia.

American Society for Testing Materials. Annual meeting at French Lick, Ind., June 20 to 24. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia.

American Railway Tool Foremen's Association. Fifteenth annual meeting, Hotel Sherman, Chicago, Aug. 31, Sept. 1 and 2. G. G. Macina, secretary, 11,402 Calumet Ave., Chicago.

American Society for Steel Treating. Ninth annual convention and national steel exposition, Detroit, week of Sept. 19. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland.

Machine Tool Exhibit. Seventh annual machine tool exhibition under the auspices of the New Haven Section of the American Society of Mechanical Engineers, the Department of Mechanical Engineering of Sheffield Scientific School, Yale University, and the Chamber of Commerce of New Haven: At the Mason Laboratory, Yale University, Sept. 6 to 9. Harry R. Westcott, chairman of the exhibit committee, 400 Temple St., New Haven, Conn.

National Machine Tool Builders' Association. First exposition of machine tools at the Public Auditorium, Cleveland, Ohio, Sept. 19 to 24. J. Wallace Carrel, vice-president and general manager, the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, chairman of the exposition committee. Ernest F. DuBrul, general manager of the cinnati. Roberts Everett, manager of the exposition, 1328 Broadway, New York City.

The Weekly Price Guide

Rise and Fall of the Market

STEEL prices are increasingly firmer at the principal centers of distribution, while non-ferrous materials and supplies appear to be experiencing a temporary period of dullness. Cold-rolled strips represent the strongest item on this week's list; other forms of iron and steel are also affected by the impending coal miners' strike, scheduled for Apr. 1. Pig-iron buying is confined to small lots, indicating caution; meanwhile coke quotations remain unchanged from the Mar. 4 levels. Railway steel buying is in good prospect. Steel bars, shapes and plates average about $1.90 per 100 lb. at Pittsburgh, with bars at a maximum of $2 and plates, a minimum of $1.80 per 100 lb., f.o.b. mill.

(*All prices as of Mar.* 11)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$22.19
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	26.37
BIRMINGHAM	
No. 2 Foundry	18.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.76
Virginia No. 2	27.17
Basic	21.76
CHICAGO	
No. 2 Foundry local	21.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	23.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.76
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.00@4.50
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	4.75@5.25

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.20@2.25	3.50	3.25	3.89
No. 12	2.25@2.30	3.55	3.30	3.94
No. 14	2.30@2.35	3.60	3.35	3.99
No. 16	2.40@2.45	3.70	3.45	4.09
Black				
Nos. 18 to 20	2.60@2.80	3.75	3.25	4.15
No. 22	2.75@2.95	3.90	3.40	4.30
No. 24	2.80@3.00	3.95	3.45	4.35
No. 26	3.90@3.10	4.05	3.55	4.45
No. 28	3.05@3.25	4.20	4.70	4.60
Galvanized				
No. 10	2.95@3.05	4.10	3.95	4.40
Nos. 12 to 14	3.05@3.15	4.20	4.05	4.50
No. 16	3.15@3.25	4.30	4.15	4.60
No. 18	3.30@3.40	4.45	4.30	4.75
No. 20	3.45@3.55	4.60	4.45	4.90
No. 22	3.50@3.60	4.65	4.50	4.95
No. 24	3.65@3.75	4.80	4.65	5.10
No. 26	3.85@3.95	5.05	4.90	5.35
No. 28	4.10@4.20	5.30	5.15	5.60

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness — Decimal	B.W.G. and Fractions	Outside Diameter in Inches — ¼	⅜	½	⅝	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	4.50	6.00@7.50	4.65
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (2.90@3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, ⅛, 8.35c.; ¼, 7.85c.; 5/32 to ½, 7.35c. per lb. *Flat, 1/16@¼-in. thick.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			13.75
Tin, 5-ton lots, New York			72.00
Lead (up to carlots) E. St. Louis	7.40	New York	8.25
Zinc (up to carlots) E. St. Louis	6.75	New York	7.75

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	16.00	18.50	16.25
Copper sheets, base	22.00	22.00	22.00
Copper wire, base	18.87½	18.87½	15.37½
Copper bars, base	21.62½	21.62½	21.62½
Copper tubing, base	24.00	24.00	24.00
Brass sheets, high, base	18.37½	18.37½	18.37½
Brass tubing, high, base	23.25	23.25	22.75
Brass rods, high, base	16.12½	16.12½	16.12½
Brass wire, high, base	18.87½	18.87½	18.87½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	26.00	26@27	26.02
Zinc sheets (casks)	13.00	12 30	11 36
Solder (½ and ½), (case lots)	42.50	43 75	38½@42½
Babbitt metal, delivered, New York, cents per lb.:			
Genuine, highest grade			88.00
Commercial genuine, intermediate grade			61 00
Anti-friction metal, general service			31 50
No. 4 babbitt (f.o.b.)			13.50
Nickel, f.o.b. refinery, cents per lb.:			
Ingots 35 00 Electrolytic 39.00 Shot			36.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50. 00
Cold drawn rods, Grade "A" (base)	58.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32. 00	Hot rolled rods (base)	35. 00
Blocks	32. 00	Cold drawn rods (base)	43. 00
Cold rolled sheets (base)	50.00	Hot rolled sheets (base)	42. 00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.62½@11.87½	10.75	10.75@11.25
Copper, heavy, and wire	10.87½@11.37½	11.00	9.75@10.25
Copper, light, and bottoms	9 50 @10 00	9.50	8.75@ 9.25
Heavy lead	6 37½@ 6.87½	6.25	6.00@ 6.50
Tea lead	5.00 @ 5.25	4.25	4.75@ 5.25
Brass, heavy, yellow	7.25 @ 7.50	7.50	6.75@ 7.25
Brass, heavy, red	9.00 @ 9.50	9.50	9.00@ 9.50
Brass, light	5.50 @ 5.75	6.00	6.00@ 6.50
No. 1 yellow rod turnings	7.50 @ 8.00	7.50	7.00@ 7.50
Zinc	4.12½@ 4.37½	4.00	3.25@ 3.75

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9 50
Coke Plates—Primes—Per box				
100-lb.	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	7.00	7 50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0. 13@0. 17½	$0.16	$0.15@0 20
Cotton waste, colored, per lb.	.09@ .13	.12	.12@ 17
Wiping cloths, washed white, per lb	.17@.17½	36.00 per M	15
Sal soda, per 175 lb. keg	2.80	2.75	2.75
Roll sulphur, per lb	04	.03½	04
Linseed oil, per 7½-lb. gal., 5 bbl. lots	81½	.98	80
Lard cutting oil, 25% lard, in 5 gal. cans, per gal.	55	50	.50
Machine oil, medium-bodied (55 gal. metal bbl.), per gal.	33	35	29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–5%	60–5%	50–10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.032
Cold drawn shafting	per lb.	.04	.04	.04
Brass rods	per lb	.1612½	.1562½	.1687½
Solder (½ and ½)	per lb.	425	.42	4025
Cotton waste	per lb.	.13@17½	13@.17½	.15@.22
Washers, cast iron (½ in.)	per 100 lb.	7 00	7.00	7.00
Emery disks, cloth, No. 1, 6 in. dia.	per 100.	3 10	3.10	3.55
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	33	33	35
Belting, leather, medium	off list	40–5%	40–5%	40–5%
Machine bolts, up to 1x30 in.	off list	40%	40%	40%

MISCELLANEOUS—Continued

		New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:				
Flint paper		$5.13*	$4.95	$5.13
Emery paper		10. 71*	9. 15	10. 71
Emery cloth		27.84*	27. 85	27. 84
Emery disks, 6 in. dia., No. 1 grade, per 100:				
Paper		1 29	1. 27	1. 32
Cloth		3 10	3. 05	3.05
Fire clay, per 100 lb. bag			.75	.75
Coke, prompt furnace, per net ton			Connellsville,	3.35@3.50
Coke, prompt foundry, per net ton			Connellsville,	4.00@5.00
White lead, dry or in oil,	100 lb. kegs		New York,	15.25
Red lead, dry	100 lb. kegs		New York,	15.25
Red lead, in oil	100 lb. kegs		New York,	16 75

*4½ reams and under.

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%) 35%

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ½x½-in., 2c. each. Discount 70% for $\frac{5}{16}$-in and smaller and 65% for ½-in. and larger.
Case hardened ½x½-in., 6c. each, less 50%.

Rivets, button heads, ½-in., ⅝-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4½-in $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{1}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all dia meters, 25c.; ½-in. dia., 35c.; ½-in. dia., 75c; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb. 50c.; countersunk heads, 45c

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅝-in., $6.00* per 100 lb

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Equipment Wanted

Ill., Chicago—Atchison, Topeka & Santa Fe R.R., 80 East Jackson Blvd., M. J. Collins, Purch. Agt.—side-rod boring and facing machine, Norton type carwheel grinding machine, carwheel journal turning machine, heavy duty piston rod grinding machine, 26 in. x 10 ft. lathe, 54 in. tire turning lathe, heavy duty coach wheel tire turning lathe, 20 in. shaper, 6 in. hack saw, automatic rip and cross cut circular saw, 4 ft. and 6 ft. radial drills, radius link grinder, four 24 in. emery wheel grinders, 20 in. drill press, 16 in. heavy duty slotter, 1,500 lb. single frame steam hammer.

Ind., Indianapolis—Bd. of School Comr., 150 North Meridian St., will receive bids until Mar. 29 for machinery, tools, woodworking benches, etc., for manual training department of Indianapolis Schools.

Md., Baltimore — Southern Couch Mfg. Co., 431 Colvin St. (upholstered furniture) —equipment for proposed 4 story factory to double capacity of plant.

Mass., Cambridge (Boston P. O.)—M. H. Gulessan, 85 Commonwealth Ave., Newton—miscellaneous tools and equipment for proposed 2 story repair and service garage here. Estimated cost $60,000.

Mass., Quincy (Boston P. O.)—S. Scammell & Son, 12 Scammell St.—miscellaneous tools and equipment for proposed garage and repair shop. Estimated cost $40,000.

Mass., Somerville (Boston P.O.)—M. Bornstein, 64 Charlesgate E., Boston—miscellaneous tools and equipment for proposed 1 story, 90 x 210 ft. repair and service garage on Medford St., here. Estimated cost $50,000.

Mich., Detroit—Peninsular Stove Co., Fort St. and Trumbull Ave.—additional equipment for the manufacture of stoves, gas ranges and furnaces for proposed 1 and 2 story plant.

Mo., St. Louis—Missouri Pacific R.R., Railway Exchange Bldg., W. A. Hopkins, Purch. Agt.—2 spindle rod boring machines, No. 5 plain milling machine, 36 in. gap spot welding machine, 10 x 36 in. Universal grinder, 24 in. engine lathe, 16 in. splitting shears, No. 1 angle iron bending rolls for Sedalia, Mo., shops; 15 ton electric traveling crane, 13 in. Universal punch and shear, squaring shears, 5 ft. radial drill, 48 in. vertical drill, No. 5 plain milling machine, 36 in. draw-cut shaper, 42 in. engine lathe, Fordson tractor with boom for North Little Rock, Ark., shop; geometric chaser grinder, 10 x 36 in. Universal grinder, sensitive drill, 48 in. vertical drill, 36 in. draw-cut shaper, Fordson tractor with boom for Kansas City, Mo., shop; 20 in. engine lathe, 42 in. vertical drill press, Fordson tractor for Osawatomie, Kan., shop; 20 in. engine lathe for Falls City, Neb., shop; double grinder, 32 in. crank shaper for Omaha, Neb., shop; 90 in. driving wheel lathe for St. Louis, Mo., shop; distributing valve test rack for Alexandria, La., shop.

N. Y., New York—Plaza Music Co., 10 West 20th St.—multiple spindle drill press, similar to number 11 Pratt-Whitney.

Pa., Pittsburgh—Bureau of Highways & Sewers, City County Bldg.—Briggs special sawing outfit, No. 5.

Pa., York—Steacy-Schmidt Mfg. Co.—one 15 ton electric traveling crane, a.c., span 30 ft. x 7½ in.

Que., Dorchester—A. Gagnon, St. Marguerite St.—complete equipment for axle manufacturing plant.

Que., Mont Joli—J. T. Ross—complete machinery and equipment, cost $10,000, for proposed sash and door factory.

Opportunities for Future Business

Ala., Birmingham—Prest-O-Lite Co., 30 East 42nd St., New York, N. Y., manufacturers of acetylene welding apparatus, plans the construction of a plant here. Estimated cost $750,000. Private plans. This corrects report of Mar. 3 issue.

Conn., Bridgeport—Crane Co., South Ave., will build a 1 story, 60 x 340 ft. factory. Estimated cost to exceed $40,000. W. J. Clark, Chicago, Ill., Archt.

Ill., Chicago—C. W. Johnson, 1335 North Clark St., will receive bids until Apr. 1 for the construction of a 3 story, 110 x 150 ft. garage at 1329-1337 North Clark St. Estimated cost $2,000,000. L. G. Hallberg & Co., 110 South Michigan Ave., Archts.

Ill., East Peoria (Peoria P.O.)—Haag Bros., West Washington St. E., manufacturers of washing machines, awarded contract for the construction of a 1 story, 150 x 160 ft. factory at 319 West Washington St. Estimated cost $100,000.

Ill., Kewanee — Kewanee Boiler Co., awarded contract for the construction of a 1 story, 80 x 200 ft. flange shop. Estimated cost $75,000.

Ill., Rockford—George D. Roper Corp., South Main St., will soon receive bids for the construction of a 1 story, 170 x 170 ft. plant for the manufacture of pumps and enameled iron products, etc. Estimated cost $200,000. Private plans.

Ind., Bloomington — Bunger Bros., is having preliminary plans prepared for the construction of a machine shop and garage. Estimated cost $40,000. Private plans.

Ind., Bloomington—H. & P. Electric Co., is receiving bids for the construction of a 2 story, 51 x 105 ft. factory. Estimated cost $42,000. Larkin Engineering Co., Granite Bldg., St. Louis, Mo., Archt. and Engr.

Ind., Evansville—W. C. Sanderson, 110 Water St., is receiving bids for the construction of a machine shop and garage. Estimated cost $44,000. Private plans. Reo-Tri-State Co., lessee.

Ind., Hammond—Anderson Nail Co., is receiving bids for the construction of a factory. Estimated cost $45,000. J. J. Marley, 5 North La Salle St., Chicago, Ill., Archt.

Ind., Michigan City—Roper Motor Co., is receiving bids for the construction of a 1 story, 83 x 120 ft. machine shop and garage. Estimated cost $40,000. K. Newhouse, 4623 Drexel Blvd., Chicago, Ill. Archt.

Ind., Mishawaka—De Rhodes Yerrick Motor Co., is having plans prepared for the construction of a 1 story, 66 x 133 ft. machine shop and garage. Estimated cost $50,000. W. W. Schneider, 120 South Main St., South Bend, Archt.

Md., Baltimore — L. Boyd & Co., 706 Light St., plans the construction of a 1 story machine and blacksmith shop at 705-707 William St.

Md., Baltimore—Locke Insulator Corp., Charles and Cromwell Sts., is having plans prepared for the construction of a 1 story addition to galvanizing plant to galvanize hardware.

Md., Baltimore—Neill Buick Co., Maryland and Mt. Royal Aves., awarded contract for the construction of a 3 story service station at Sisson and 26th Sts. Estimated cost $100,000. Noted Feb. 3.

Mass., Cambridge (Boston P. O.) — Boston Machine Screw Co., Tudor St., awarded contract for the construction of a 2 story addition to manufacturing plant.

Mass., Cambridge (Boston P. O.) — Kendall Industrial Building Trust, F. D. Leland, Kandall Sq., awarded contract for the construction of a 6 story factory. Estimated cost $3,000,000. Lockwood, Greene & Co., 24 Federal St., Boston, Archts. and Engrs.

Mass., East Boston (Boston P. O.)—Atlantic Works, 80 Border St., plans the construction of addition to machine shop. Estimated cost $40,000. Architect not selected.

Mich., Detroit — Peninsular Stove Co., Fort St. and Trumbull Ave., is having plans prepared for the construction of a 1 and 2 story stove plant on Burt Rd. Estimated cost $1,000,000. A Kahn, 1000 Marquett Bldg., Archt.

N. J., Jersey City—Yale Electric Corp., 60 Tillary St., Brooklyn, N. Y., plans the construction of a plant at Mill Rd., Cornelius Ave., Academy and Wayne Sts. Estimated cost $1,000,000. Architect and engineer not selected.

O., East Liverpool—Patterson Foundry & Machine Co., R. L. Cawood, Pres., awarded contract for the construction of a 2 story, 50,000 sq.ft. building for general offices, engineering department, laboratories, experimental and pattern making departments, also 100,000 sq.ft. building for machine department.

Pa., Coraopolis—Standard Steel Spring Co. will build a 1 story, 75 x 240 and 120 x 240 ft. factory. Estimated cost $150,000. J. M. Schoonmaker, c/o owner, Engr. Noted Feb. 17.

Pa., Elkins Park (Philadelphia P.O.)—L. L. Miller, Real Estate Trust Bldg., Philadelphia, awarded contract for the construction of a 1 story, 160 x 247 ft. garage and service station here.

Pa., Philadelphia—Associated Realty Co., 1600 Walnut St., awarded contract for the construction of a 4 story, 60 x 86 ft., 30 x 36 and 50 x 90 ft. repair and service garage at 13th and Waverly Sts.

Pa., Philadelphia—Jno. J. Griffin Inc., 1513 Race St., manufacturers of meters, will soon award contract for the construction of a 5 story, 20 x 99 ft. addition to plant. A. W. Barnes, Perry Bldg., Archt.

Pa., Philadelphia — Isadore Sley Co., Raquet Garage, 1602 Chancellor St., is having plans prepared for the construction of an 8 story, 60 x 80 ft. garage. Estimated cost $190,000. L. B. Rothschild, 215 South Broad St., Archt.

Pa., Pittsburgh—Keystone Box Co., 28th and Smallman Sts., awarded contract for the construction of a 4 story, 50 x 100 ft. addition to factory. Estimated cost $40,000.

Pa., Pittsburgh — Schenley Apartment Co., Fifth and Bigelow Blvd., awarded contract for the construction of a 3 story, 66 x 127 ft. garage on 5th Ave. Estimated cost $150,000.

Tenn., Yale—St. Louis San Francisco Ry., St. Louis, Mo., awarded contract for the construction of a new terminal and shop near here. Estimated cost $105,000. F. G. Jonah, Ch. Engr. Contracts for roundhouse, mechanical shops, car buildings, etc. will be awarded later.

Wis., Galesville—George Roll Mfg. Co., G. Roll, Pres., plans the construction of a 1 story, 50 x 60 ft. shop and service station. Estimated cost $40,000. Architect not selected.

Wis., Richland Center — Southwestern Veneer & Box Co., R. C. Burnham, Pres., plans the construction of a 1 story, 100 x 140 ft. factory. Estimated cost $40,000. Architect not selected.

B. C., Vancouver—J. Coaghlaus & Sons, Columbia St. and First Ave., will build a fabricating shop on Columbia St. Estimated cost $150,000. Private plans.

Ont., Toronto—Brooks Steam Motors Ltd., Metropolitan Bldg., plans the construction of an 8 story, 100 x 200 ft. automobile service building. Estimated cost $500,000. Architect and engineer not selected.